Role of Economics in Integrated Resource Management

Hinton, Alberta
16 - 18 October 1985

T.J. Cottrell
Editor

FORESTRY, LANDS AND WILDLIFE
Resource Evaluation and Planning Division

Pub. Number: T/133
ISBN: 086499-403-6

LIMITED COPIES OF THESE PROCEEDINGS MAY BE OBTAINED FROM THE:

Information Centre
Alberta Energy/Forestry, Lands and Wildlife
Main Floor, Bramalea Building
9920 – 108 Street, Edmonton, Alberta
T5K 2M4

Telephone: (403) 427-3590

Copies of these proceedings may be viewed in the:

Library
Alberta Energy/Forestry, Lands and Wildlife
9th Floor, South Tower, Petroleum Plaza
9915 – 108 Street, Edmonton, Alberta

TABLE OF CONTENTS

Page

INTRODUCTION 1

KEYNOTE ADDRESS

The Honourable Don Sparrow, MLA
Associate Minister, Public Lands and Wildlife 3

SESSION I

1. The Evolving Importance of Economics in Integrated Resource Management 7
Mr. L.J. (Les) Cooke

2. The Application of Economic Analysis to Public Land and Resource Management: An Overview 17
Dr. Terrence S. Veeman

3. The Use of Economic Information in Political Decision-Making in Alberta 29
Mr. Stephen Stiles, MLA

SESSION II

4. The Use of Economics in Resource Planning in British Columbia 41
Dr. Roger Reid

5. The Role of Economics in Public Land and Resource Planning and Management in Ontario 57
Dr. Mike Klugman

6. The Role of Economics in Public Land and Resource Planning and Management in the United States Department of Agriculture, Forest Service 59
Dr. John Hof

7. Esso's Cold Lake Project: Its Potential Application for Integrated Resource Planning in Alberta 65
Mr. H.A. (Sandy) Bruce

8. Addressing the Social and Economic Impacts of Integrated Resource Planning 83
Professor Douglas R. Webster

9. Multiple Objective Planning: Its Potential Application for Integrated Resource Planning in Alberta 93
Dr. Marvin S. Anderson

10. The Valuation of Intangible Benefits and Non-Market Commodities: Techniques and Approaches Applicable to Resource Planning and Management 109
Dr. Elizabeth A. Wilman

11. An Overview of Econometric Modelling With Applications to Resource Management 131
Dr. John R. Livernois

Workshop A

Opportunities to Apply Economic Analysis to Sub-Regional Integrated Resource Planning

12. Opening Remarks 141
Moderator: Mr. Andy Bowcott

13. Integrated Resource Planning: A Review 143
Mr. Brian Fardoe

14. Valuation 149
Mr. John Marczyk

15. Efficiency/Equity and Other Considerations in Incorporating Economic Analysis into Resource Planning .. 151
Mr. Dave Belyea

Workshop B

Approaches to Applying Economics in Regional Integrated Resource Planning

16. Opening Remarks 155
Moderator: Mr. John Brownlee

17. Thoughts on Regional Planning 157
Mr. Brian Chinery

18. The Agricultural Land Base Study 161
Dr. Alf Birch

19. Public Resource Planning and Economic Analysis 167
Dr. Mike Klugman

20. Techniques of Economic Analysis in Regional Planning 169
Professor Douglas R. Webster

21. General Discussion 175

Rapporteur's Remarks

1. Report for Workshop A 187
Mr. Ian Dyson

2. Report for Workshop B 189
Ms. Susan Calp

3. Symposium Rapporteur 191
Dr. Guy Swinnerton

Appendix 1 – Symposium Participants 201

PREFACE

Since this symposium was held, the former Department of Energy and Natural Resources was reorganized, resulting in the separate Departments of Energy and Forestry, Lands and Wildlife. The Hon. Don Sparrow, who was then Associate Minister of Public Lands and Wildlife, is now the Minister of Forestry, Lands and Wildlife. Although the cover of the proceedings states Alberta Forestry, Lands and Wildlife, all references within the document to departments, agencies and positions are as they were at the time of the symposium in October 1985.

The Resource Planning Branch of Alberta Forestry, Lands and Wildlife hosted this symposium to bring together people from various fields and jurisdictions to explore economics as it relates to integrated resource management. These proceedings portray what transpired.

This document has three parts. The first contains the keynote address and papers. The papers appear in the order presented in the symposium. They are taken from either documents submitted by the authors or verbatum transcripts of the authors' speeches which were then revised and approved by the authors. References have been cited for each paper. Question periods following the speeches have also been included.

The second part contains reports of Workshops A and B. These were working sessions for the participants to address the techniques, methods and nuances of integrating economic analysis with resource planning and management. Many of the ideas presented in the papers were discussed in depth. Workshop A dealt with sub-regional planning whereas Workshop B dealt with regional planning within the framework of integrated resource management.

The third part consists of reports of results of the workshops and main sessions. Reflecting the views of the individuals who compiled them, these reports provide a summary and evaluation of the results of the symposium.

To produce the proceedings, verbatum transcripts were used of most papers, the question periods, workshops and rapporteur's remarks. Grammatical and language revisions were made without any intention to change the meaning of what was said. As a result, the style of the proceedings is somewhat casual. The language used is often that of open discussion, and is more informal and personalized than would normally be the case in academic journals. There are frequent references to other speakers, participants and discussions.

ACKNOWLEDGMENTS

On behalf of the branch and the department, I would like to express my sincere thanks and appreciation to several people in particular, for making this symposium a reality. They devised many ideas, devoted a lot of time and expended a great deal of energy. We are indebted to them all. By all accounts, this symposium was very much a success and contributed significantly to the understanding of land use and resource management in Alberta.

The idea for this symposium originated with Andy Bowcott. Seeing the need to examine this topic, he proposed a symposium to bring together people from different fields and jurisdictions to exchange ideas and information. As chairman of a semi-formal organizing committee, Andy pushed to keep the idea growing. He is principally responsible for developing the program, and planning and organizing the event. We are particularly appreciative of his initiative and effort.

All members of the organizing committee deserve credit for their work. Tasks and responsibilities were:

Jim Rivait	– organized social events, contacted companies and obtained necessary supplies and materials.
Keith Leggat	– made arrangements for the facilities at the Forest Technology School in Hinton.
Nora Mortemore	– organized registration, made travel arrangements and handled all logistics.
Annette Bron	– handled the registration process.
Craig Taylor, Paul Short	– were the meeting and greeting committee. They met speakers at the airport and hosted a welcoming party for them.
Brian Fardoe, Peter Kinnear	– gave substantial organizational support and helped with many last minute preparations.

The Hinton Forest Technology School, under the able guidance of Bernie Simpson, deserves special mention. Bernie and his staff did an excellent job hosting us for three days, particularly since this was the first meeting of this type held at the school. They were efficient and friendly, and prepared plentiful, delicious meals.

A special thanks goes to Ruth King who typed the entire text and worked through many revisions and corrections.

Thank you all for a job well done.

Ed Wyldman,
Director,
Resource Planning Branch

INTRODUCTION

Economic and financial considerations permeate our everyday lives. At a personal level, we make economic decisions but may only be slightly aware of the process by which economics is incorporated in our decision-making. On a working level, however, it is necessary to be more definite. We should know which economic matters are important, what process to follow to consider them and how they influence decisions. The success of our efforts will show in the results – the decisions will speak for themselves.

Some decision areas are influenced by economic and financial matters much more strongly than others. As well, we experience varying degrees of success attempting to integrate economics with environmental, social, technical and other aspects in the decision-making process.

Land use and resource planning and management in Alberta have been based largely on the characteristics of the land and resources, the inherent capability to support certain uses, ecological values and political priorities. Economic considerations have to date played a relatively small part in the decision-making.

Changes in our economy and society, however, now make it mandatory that we change our approach. For society to grow and develop through the use of land and resources, and yet maintain the quality of our environment, economic factors have to be considered in more depth. We have to look closely at the process to incorporate economics and assess how and why resource planning and management decisions are made or reached. We have to place considerably greater emphasis on economic aspects in land and resource planning, and use economic and financial information in conjunction with traditional types of information.

Placing greater emphasis on economic variables won't mean less emphasis on the ecological, land or resource criteria, or indeed that the quality of the land and resources will suffer. Instead, it will mean an improved decision-making process, better decisions and greater overall net benefit to society.

This symposium was organized to meet this objective and to bring forth fresh ideas for the land use and resource management system.

KEYNOTE ADDRESS

by: THE HONOURABLE DON SPARROW, MLA *

(Read by Mr. Stephen Stiles, MLA) * *

Good afternoon to you all. I am pleased to be here before you today to provide some opening remarks for this Symposium on The Role of Economics in Integrated Resource Management. It is a subject which is of great interest to me and of great importance to the province.

Before I begin let me say that I am particularly pleased to recognize so many faces from public interest groups and industry. As the objective of this event is to seek a consensus on the appropriate role that economics should play in Alberta's integrated resource management system, it is important that the non-government participants in that system are represented here today.

I would like to extend a special welcome to those who have so generously offered their time and expertise and have prepared papers for presentation to this gathering. Collectively, you represent an impressive array of talent and I'm sure your insights will be enlightening. I would also like to compliment members of the Resource Planning Branch for the splendid organization of this Symposium, particularly Andy Bowcott and his team.

In addition, I would like to extend a warm Alberta welcome to our guest speakers from Ontario, British Columbia and the United States. We appreciate your coming to share your experiences with us.

It is a particular pleasure for me to be invited here to speak this afternoon because I feel the subject is so timely and important. The Alberta economy is predominantly resource based. In addition, the majority of the land and resources in the province are vested in the Crown; that is they are publically owned. It is, therefore, of utmost importance to Albertans that the management of this public land and these resources maximizes the benefits from them both now and in the future.

The Government of Alberta establishes and expresses its resource management policy for specific geographic areas within the regions of the province through integrated resource planning. Integrated resource plans direct the management of the various public land and resource sectors towards an optimum blend of uses and activities.

The integrated planning process begins with an assessment of the existing natural systems and the inherent capabilities of the resource

---

* Associate Minister of Public Lands and Wildlife, Department of Energy and Natural Resources, Edmonton, Alberta.

** Chairman, Alberta Integrated Planning Advisory Committee, Edmonton, Alberta.

base for various uses or activities. Alberta's integrated resource management system is built on a foundation of high quality renewable and nonrenewable resource inventories and assessment information.

The integrated resource plans are prepared by inter-agency planning teams. Individual resource agencies propose management objectives based upon assessments of capability, present use and existing and future demand. Through a detailed and comprehensive process of analysis and review, these resource objectives are integrated into an overall resource management strategy for an area. The general public, public interest groups, industry groups, local authorities and members of the Legislative Assembly all have opportunities for involvement throughout the planning process. Once consensus on a resource management strategy has been achieved, following extensive public and governmental review, the integrated resource plans are forwarded to me. When I am satisfied with them I present them to the cabinet committee for final approval.

The provincial government strongly supports integrated resource management and the integrated resource planning process. It is the intention of the provincial government to have all public land and resources planned for and managed in an integrated fashion.

I would like to turn now to the focus of this symposium. As I indicated earlier, the essence of integrated resource management is the optimization of resource use to achieve maximum benefits for Albertans now and in the future. What should be the role of economics in Alberta's resource management system? This is the fundamental question this symposium is challenged to address. How do we optimize resource use in order to maximize benefits for Albertans? How do we determine the optimum? How do we measure benefits? It is not a simple process. In the final analysis, I think we reach an optimum which combines environmental, social and economic dimensions with a political judgment of what is in the public interest.

The Government of Alberta is committed to integrated resource management and the integrated resource planning process as a means of defining resource management policy on a geographic basis throughout the province. In support of this objective, our biophysical information base is excellent. With the new technologies we are acquiring to represent that information, this aspect of decision-making can only improve. Our integrated planning process is effective and our resource specialists and planners first rate. I feel we make an honest effort to involve the public in our planning process; consulting those affected or influenced by potential policy choices in order to determine the social implications before making decisions. In these areas I am satisfied.

As Associate Minister, I am responsible for recommending for approval to cabinet resource management policies which may have significant economic implications – implications for government expenditures and revenues, implications for the health of old or new industries, implications for local or regional development, implications for private or public sector investment opportunities, implications for resources the value of which must be considered in terms of non-market values or intangible benefits.

With respect to these aspects, integrated resource management in Alberta can be improved. I will strongly encourage efforts be directed towards making such improvements. We must include economic information with other resource information provided in integrated resource planning exercises. Resource values and resource objectives can be quantified. We must adopt techniques which permit estimation of value for resources which have imperfect or non-existent markets but on which Albertans clearly place value. When a course of action or a policy is recommended for decision to cabinet, the relative economic costs or benefits of alternative resource allocations or policies should be provided along with other relevant resource and public involvement information.

We should also know the cost of implementing integrated resource plans – whether these costs will be borne by the private or public sectors – and what will be the regional and provincial employment and income effects of implementation of these plans. I don't expect these improvements to be made overnight and I recognize that they must be compatible with the other elements of the integrated resource management system.

In closing, I would like to add one final comment. We have developed a made-in-Alberta resource management system which reflects not only our diverse resource environment but our own particular social and political traditions. The role we recommend for economics in this system must also be considered in light of these factors. We seek a consensus on an appropriate role for economics in integrated resource planning and decision-making which complements the strengths of the system as it exists.

As I said, I don't expect these changes to be made overnight but I do expect them to be made. That is the challenge I wish to leave with you as participants in this symposium and as participants in Alberta's integrated resource management system.

Good luck and have a successful three days. Thank you.

THE EVOLVING IMPORTANCE OF ECONOMICS IN INTEGRATED RESOURCE MANAGEMENT

by: L.J. (Les) Cooke*

Historical Change

Resource and land management systems evolve continuously over time. In Alberta, the planning and management of Alberta's public land has changed dramatically over the last 25 years. In order to understand the increasing role of economics in resource management in Alberta, it is important to review briefly the evolution of integrated resource management as the philosophy of public land management.

Before 1930, Alberta's public land was managed by the Government of Canada. The management approach was reactive, exploitation oriented and relatively benign. Most resources were available on request, with simple rights conveyed in the form of concessions for development and/or extraction.

After 1930, with the transfer of responsibility for public lands and natural resources to the province, the orientation to simple, reactive, sectoral management continued. Over time, an autonomous, self-sufficient organization developed for each of the resource sectors. These functionally integrated, sectoral organizations incorporated complete legislative, policy, planning, administrative and operations functions.

Changes in society, beginning in the 1960s, have had a profound effect on land and resource management. The worldwide "environmental" movement created fundamental changes in society's attitudes and expectations. The need to change our basic approaches to land and resource management was recognized by all participants – public officials, politicians and the general public. The changing attitudes stressed the need for more balance between development and conservation, more planning and much more integration. "Multiple-use management" was the embodiment of this concept.

The organizational reflection of this fundamental philosophical change featured some important improvements and some significant failures and frustrations. The realization that a comprehensive, accurate information base was a prerequisite to good management led to major inventory programs such as the Canada Land Inventory. Also initiated were a series of undirected, experimental planning programs which did not produce successful plans but certainly laid the groundwork for the planning successes experienced later in Alberta.

---

* Assistant Deputy Minister, Resource Evaluation and Planning Division, Alberta Energy and Natural Resources.

Institutionally, the traditional organizations strained to accommodate the changing philosophy. An explosion in the number of interagency committees reflected the organizational stress as communication and co-ordinating systems were designed quickly and often haphazardly. Regulatory processes were often seen as the quick fix, and such processes proliferated. While the attitude change, information programs and early planning initiatives set the stage for the 1970s, the whole process of change needed overall direction. It needed to be integrated into the land and resource management system in Alberta.

By the mid-1970s the concept of integrated resource management had evolved in Alberta as the approach for public land and natural resource management. What is integrated resource management? It is integration in both the decision-making systems and the use of land and resources. It is a proactive rather than reactive approach to management. It is long range, and future-oriented in its perspective.

Integrated Resource Management and Planning

Integrated decision-making; shared decision-making at all levels; high levels of co-ordination; consensus management; participation; organizational and institutional change; changes in decision-making processes. You've heard all these things before – none of this is new. All these things need to be embodied in the decision-making systems.

Integrated resource planning is an important new component of public land management in Alberta. It is not an independent function. When you look back in time, you will find that the failure of planning systems is usually linked to a decision to try to separate the planning from the management function. Planning is one of the prerequisite but component parts of management. It should never be made independent or conducted in isolation.

What are some of the principles that we've tried to embody in integrated planning in Alberta? While some of these may sound somewhat academic, a review of the last ten years will identify these principles as fundamental characteristics of our planning program, and the reason for our successes.

1. Planning should occur within the context of a comprehensive, hierarchical framework.
2. Integrated planning is a progressive refinement of management decisions. One of the difficulties in planning is trying to get all the decisions made at any particular point. We recognize today that there are policy decisions, planning decisions and operations decisions, and all of these are linked.
3. Planning must be objective. It must have some rational, logical processes inherent in it.

4. Planning must be oriented towards benefits. Without any question, our planning system is designed to maximize benefits. The concept, in the late 1960s and early 1970s, of doing planning in a smoke-and-mirrors environment where the bottom line was never really clear, was extremely difficult and undesirable to continue.
5. The fifth principle is one of efficient resource management. The land and natural resources have integrity which must be respected. There are limitations. There are characteristics that limit the decisions that can be made.
6. The planning system must be dynamic and flexible; dynamic in the sense that values change over time. You must be able to accommodate these changes. If you read any of the planning literature that exists today, you'll find these terms used *extensively*. If you look at any of the planning programs today, you'll be hard-pressed, in many of them, to find any evidence of a dynamic or flexible approach to decision-making. These aspects are probably the most difficult to try to accommodate in a system.
7. The planning process must be participatory. Those people who have a responsibility for making the decision and those affected by it must both be party to it.

This description has been a very basic outline of the ideas, concepts and thinking behind integrated resource management. Most of the principles described were considerations in 1975 when the first commitment to integrated resource management was made by the Alberta government. Most of those characteristics have continued throughout the planning activities to date.

The Planning Process

The planning process is simple and well known. It is basically a strategic-choice method that analyses information, looks at some options and makes decisions. In our system we have made certain choices about how we will organize the planning program. While there are other ways to do these things, we have tried to develop a system that would be best suited to Alberta's needs.

In Alberta, we work at four scales of resource planning – provincial, regional, sub-regional and local. The provincial level is a policy development, policy examination process where we try either explicitly or implicitly to draw, from the province's policy base, those things that we need to make planning decisions on natural resources. The regional plan is a strategic, decision-making tool. Basically, it provides regional direction. The sub-regional plans which, as everybody is aware I consider our bread-and-butter plans, deal with land and resource allocation. We expect those plans to give us enough information to suggest which uses should occur, where and under what conditions. Local planning has come onto the scene in the last two years. We think it is going to become a bigger part of the planning program in the future. If we've done a good job of introducing the principles enunciated earlier, we will see strong local pressure to continue the planning program to the local planning level.

The structure of the integrated resource planning system has been described elsewhere, so I will simply highlight some of the more important components. Planning is undertaken by planning teams. We strive for a team in which the planner acts as a process facilitator but does not take an active or over-riding role in the decision-making process. We are aware that the person who selects the alternatives can shape the decisions. How those alternatives are presented will be reflected very clearly in the decision. The teams are organized to consist of the people who have, in advance of the plan, the decision-making authority. Planning does not change the decision-making systems – it reflects them. For example, in an area of the province where resource decisions are being made by Fish and Wildlife, Forestry, Public Lands and Mineral Resources, those agencies' staff should continue to make the decisions. The staff should also make the planning decisions. The members of the planning teams typically come from the field staff of our resource management agencies.

The planning teams make decisions by consensus. We have very much a consultative approach. In the last three or four years, we have concentrated on developing a public involvement program that reflects the principles we've espoused for some ten or more years, where people feel comfortable that their views have not only been noted, but have been considered and responded to *seriously*.

Implementation in Alberta

To wrap up this very general and simple description of what's involved in integrated resource management and planning in Alberta, I'd like to reflect on the last ten years and leave you with eight observations which are fundamentally important in the development of integrated resource management.

1. Integrated resource management is a reflection of the government decision-making system. It is not some bright idea hatched by bureaucrats ten years ago, or that some theoretician described and we adopted. The introduction of integrated resource management and planning was possible at the time because the government decided that the old approaches to decision-making were inadequate, and new ones were required. In 1971, the Alberta government vitalized the cabinet committee system. No longer was a minister able to make independent decisions about land and resources. By the mid-1970s any major policy decision

affecting public land and natural resources was being made by cabinet on the advice of a cabinet committee. Integrated resource management is a reflection of the government system, not an independent creation.

2. You must have a top-down approach to developing this type of system.
3. You must work from an established concept rooted in some fundamental objectives.
4. You must proceed in an evolutionary way, not a revolutionary way. Observing the approaches used in other provinces and countries, we've seen consistent failure where a revolutionary approach has been attempted.
5. The planning program must be manageable. When we first started to work on the planning system in the late 1970s, there was a good deal of criticism concerning things we were not doing. As our consideration was for manageability, we've tried to introduce each step in the integrated resource management system as we have effectively managed the ones before it.
6. Another observation is the requirement for institutional change. It is not possible to create a major change in a resource management philosophy without creating organizational change. It is also necessary to measure progress and to control expectations. Again, I must emphasize this was major change. It is not possible to create, in one or two years, the kind of change required by a new management system for public land and resources.
7. There is a strong need for solid, effective marketing of the planning system – "education" – not the hard sell. When you're introducing a new concept that involves, in Alberta's case, thousands of people and tens of thousands of decisions, it is necessary to introduce people to it over a long period. A good deal of patience is necessary in dealing with people.
8. The last observation, which I think we have successfully addressed, is the need for the planning system to be integrated with short-range decisions. The historical approach to preparing plans is to impose a moratorium on decision-making in an area while the planning considerations are addressed. This approach usually produces difficulties for the planning process. A way to integrate effectively the planning with the short-term decision-making, is essential.

Economics and Resource Policy

I would like now to address the matter of economics. As I mentioned in my previous remarks, the integrated resource management system is an evolving system. In the context of manageability, we have been incremental in the way we have introduced new concepts.

The next step in the evolving system is the introduction of economics into the decision-making processes in a complementary way. This is not to suggest that our system has been devoid of economic information or economic elements – it has always included elements of economics. In Alberta we have built our systems from the biophysical base, adding social parameters, and now we need to concern ourselves with questions of economics. Anyone who has followed the economic history of this province, particularly in the last ten years, will understand why we need to address this matter now.

The place to begin understanding economics and its role in integrated resource management is to look at resource policy. Resource policy is not an entity in itself. Resource policy is something often not stated explicitly, but it *does* exist. The challenge for people who work in a decision-making environment is to identify it. How do you enunciate it? How do you relate it to the kind of decisions you're making?

To understand resource policy we should reflect again on the history of resource management. Along with the sectoral organizations I mentioned previously came different value systems. When I worked for the Mines and Minerals Department in the mid-1970s, the fundamental objective of that organization was very clear. It was to maximize economic returns to the province, either through private sector activity or the royalty and fee system in place at the time. If one examines the agricultural sector over the last 30 or 40 years in Alberta, one sees a very strong social commitment to a certain way of life, to a certain approach to managing land. If one looks at the forestry sector over the last 25 years, one sees a very major commitment to biophysically-sound, long-range resource management.

I'm not suggesting that, in any of these sectors, the other values were entirely absent. I think we can easily see that, from a policy standpoint in this province and probably any other government jurisdiction, we have had different value systems in force in each of these and the other resource sectors.

I would like to introduce my perception of what goes into government decisions about land and natural resources. It is a blend of the biophysical framework, the social objectives of the province and the economic benefits. Really, when you think about resource policy in Alberta, we're always talking about the balance between these three broad policy ingredients.

When we address ourselves to integrated planning, the first question that invariably comes up is, "How are we going to get integrated policy?" Well, quite frankly, I think the answer is we're probably not going to get it. I don't think it is realistic today to expect that we can simply roll together policies developed for energy resources, development of forest products, agricultural development and other resource uses into an integrated policy that states a whole series of priorities.

I'm not saying that at any one time any one of us couldn't identify the real priorities for resource development. Probably from each of our perspectives that list might be a little different, but not a lot. To expect to see that list embodied in a policy document today is not realistic. We must, however, have processes that, for specific decisions, plans and situations, can take that information and integrate and direct it to any specific decision-making process.

Probably the best example in Alberta of the change that occurs in the blend of these three major value sets is that which transpired between 1977 and 1984 in the province's Policy for Resource Management of the Eastern Slopes. In 1977, the policy reflected a very strong social commitment to environmental protection and the integrity of the land and the resources themselves. A biophysical management system was introduced in the 1977 policy.

In 1977, the news of the day was the announcement of the Eastern Slopes Policy. That was big news in 1977. People were concerned about those kinds of things. They were not particularly concerned with how to create more economic activity in the province. The last thing we were concerned with was how to create *more*. We were concentrating on managing what we had at the time. I can remember having discussions with the Coal Association of Canada concerning sources of capital to support the numerous coal development proposals. It was a genuine concern in 1975/76 that there would be an inadequate supply of capital because of all the competing developments that were taking place in this province. Today we must address how and where we can create development opportunities.

In the revised 1984 policy, we still see a strong commitment to environmental protection and the biophysical approach. But we now have clarity as to what is expected from the system when all the planning and decision-making systems are working – benefits, and particularly, economic benefits. The reason for this clarity is the change in the economy of the province over those seven years.

We're looking at a change, a fundamental change in our society. The need for Albertans to concern themselves about economic benefits suggests that they now want economics dealt with more explicitly. Again, I emphasize that in 1977 economics was a factor, but it took care of itself and needed little consideration from decision-makers. In 1984 it needed that attention. In 1985 it continues to need that attention.

It is interesting to examine the way that economics is being introduced into our decision-making systems. One can draw parallels between the introduction of economics and the way that environmental considerations were introduced to the same decision-making systems in the late 1960s and early 1970s. The initial response to enhancing environmental components of land decision-making was entirely at the operations level. Environmental legislation was introduced which, interestingly enough, did not address policy or planning. It addressed referral systems, operational controls and regulations. Most of it centred around environmental *impacts*. The response was very project specific with no allowance for foresight.

Exactly the same thing is initially happening with the attempts to introduce economics in a full and complete way to our decision making processes about land and resources in Alberta. Our initial reaction is, "What are the economic implications of decision "X"? What effect is it going to have?" You can see this approach very clearly in our response to consider economics more fully in the integrated planning program. The first efforts have been to wait until the plan is done and then to do what you could effectively describe as an economic impact statement. What are the implications for employment, for government infrastructure programs?

Just as we recognized in the early 1970s that impact assessment would not do the complete job for us in environmental matters, we also recognize today that impact assessment will not do the job for us in the economic sector. That approach is not the way to introduce economics effectively into our decision-making processes. We need a new approach, a different way of doing things. We need to find a way to incorporate the economic values into the decisions themselves. We need in our planning program, to find a way early in the process to integrate the economic values with the biophysical and social values that are already well addressed in that process. It is not enough to wait until the end of the program. We have to examine the alternatives from the standpoint of their economic implications.

To meet this goal we need to do a number of things. Some of them are happening now. Some will appear to be dynamic today, and some will happen in the next years. Firstly, we need to identify more explicitly the policy objectives for each of the resource sectors in this province. In understanding the policy objectives, I think we can more effectively consider their integration into a planning or decision-making system. Secondly, we must find a way to develop economic information in a manner more relevant to today's planning and decision-making processes. Thirdly, we must make adjustments in the planning process itself that will allow us to balance economic with biophysical information.

Conclusions

Resource policy in Alberta today is largely implicit. It is difficult to adjust decision-making processes without reducing a number of policy considerations to more explicit statements. The Eastern Slopes Policy is an excellent example, for those people examining the effects of the change in our value systems, of a successful marriage of social, economic and biophysical objectives. I believe the Eastern Slopes Policy was well received in 1977 because it reflected the combination of objectives people were looking for at the time. Any difficulty in relating to the 1984 policy I think comes from failure to recognize the change in the balance of that marriage that has occurred in the last seven years.

What must we in the planning system do? We must continue to evolve into the field of economics. We are now addressing economic impact. We must find a way to move away from the economic impact to incorporation of economics in the decision-making process. We need to devise more explicit policy. We need to consider major changes in our inventory and information gathering programs to incorporate economic information. We need to look at fundamental changes in the planning process and the planning understandings today in the people that do planning. We must respond to the common complaint from people in the resource industries that the planning program is not sensitive to economics. We have to find a way of incorporating that perspective into the planning program. With that I'll conclude and be glad to answer any questions. Thank you very much.

QUESTION PERIOD

CHAIRMAN:

We have about seven minutes. Are there any questions you'd like to direct to Les? Will Knedlick.

WILL KNEDLICK:

Sir, I'm wondering if you're considering the kind of processes that do demand integration of economic considerations, from the very beginning of the planning process, of the kind that the World Bank and the IMF, and for that matter FAO, have required for at least two decades in making allocation decisions to all these less developed countries for the development of their resource sectors, or if you have something in mind that's drastically different from that kind of model?

LES COOKE:

We see the introduction of more economics into our decision-making processes as being "in context". We do not intend to redefine the whole planning system. We feel that the nature of the processes and the nature of the approach we use today is fundamentally good. We feel the balance needs to shift in that process, and that is going to cause a number of further adjustments. We're going to have to see adjustments in the knowledge, let's say, of all participants. We're going to have to see adjustments in the information base put on the table when these decisions are being considered. But I do not think we will see anything as dramatic as stepping back from it and laying out a very, very broad set of objectives that would be almost pre-conditions to any kind of decision-making process. Thank you very much.

CHAIRMAN:

Thank you again, Les. That was an excellent presentation. I agree with every word of it and so do all the planning staff. I hope it's on tape because I might use it myself some day. We'll now have a 15-minute coffee break.

THE APPLICATION OF ECONOMIC ANALYSIS TO PUBLIC LAND AND RESOURCE MANAGEMENT: AN OVERVIEW

by: Dr. Terrence S. Veeman*

Critics of the historic management of natural resources in Canada have sometimes lamented that Canada is a nation "rich in resources but not in resource policy." Economists, too, often feel that the public management of natural resources does not sufficiently incorporate basic principles of their discipline. On the other hand, many environmentalists and ecologists have suggested that economic values and logic are an insufficient basis for resource decision making. The purpose of this paper is to outline and critically discuss the basic principles of economic analysis as they might be applied to the societal management of public land and natural resources, particularly with reference to the Province of Alberta.

Economics and Value

The Concept of Value

Oscar Wilde once described the cynic as "one who knows the price of everything and the value of nothing." Indeed, this epithet has also been used to describe economists. For at least two centuries, great moral philosophers and economists have struggled with the attempt to find those qualities which give an object value. Early classical writers such as Adam Smith and Ricardo tried to explain value (pricing) primarily in terms of differential costs of production. They distinguished between "value in use" and "value in exchange." As the discipline of economics developed and utility theory was incorporated, "value in use" was largely ignored (Barkley and Seckler 1972). Modern economists increasingly recognized value as "value in exchange" and used the terms "value theory" and "price theory" interchangeably.

As a consequence, modern value theory, from Alfred Marshall onward, considers the value of a commodity to be the quantity of goods and services for which that commodity can be exchanged. Since money is the current medium of exchange (and not gold, salt, or cigarettes as in previous times and places), the exchange value of a commodity is measured in terms of its price, that is, the quantity of money for which the commodity can be exchanged (Mueller 1985). The price or exchange value of goods, in turn, is determined simultaneously by considerations of supply (cost) and demand (utility or preference). Underlying the pattern of demand is the doctrine of consumers' sovereignty – the notion that each individual is the best judge of what he or she wants. Moreover, the marginal utility associated with goods is tied to a person's marginal willingness to pay. Implicit, too, is the assumption that the consumer's wants are insatiable – more is preferred to less. Such assumptions clearly can be criticized, but are unlikely to be abandoned completely.

---

* Departments of Economics and Rural Economy, University of Alberta, Edmonton, Alberta.

The fact that goods have value can be ascribed ultimately to the scarcity of resources and the aspect that these resources have competing uses. If goods were available in unlimited supply, they would be free. Typically that is not the case, and price must serve as a rationing device for goods or resources, particularly those with exclusive property rights. In so far as the valuation of natural resources is concerned, it is also important to remember that natural resources are multi-attribute and thus have quantity, quality, time and space dimensions (Randall 1981).

Economic values are regarded to be relative values and not "intrinsic" values (Power 1985). Economic values are typically couched in terms of opportunity cost. The value of an extra gun is the amount of butter you would be willing to give up to obtain the gun. Economists do not try to determine what something, like education or clean air, is worth in and of itself. Economic values are typically marginal or incremental values, rather than total values.

Types of Values

It is important, at the outset, to note that public decision making with respect to public land and natural resources in Alberta must be as concerned with extra-market values as with market-determined values. Timber and wheat can be readily valued in terms of market prices, but the extra-market values associated with the recreational or watershed functions of public land must be imputed. It is analytically useful, following Charles Howe (1971), to distinguish four categories of values (or types of benefits and costs):

1. economic values for which market prices exist and for which these prices correctly reflect societal opportunity costs or true scarcity values; for example, farm or timber outputs which are not price supported
2. economic values for which market prices exist but for which the prices fail to reflect appropriate scarcity values or shadow prices; for example, price-supported commodities or labor inputs that would otherwise be unemployed
3. economic values for which no market prices exist but for which appropriate social values can be approximated in money terms, by inferring what consumers would be willing to pay for the product or service, either through direct surveys or indirect techniques such as the Hotelling-Clawson-Knetsch method of extra-market

benefit estimation; for example, forest-based recreation or hunting and fishing

4. values for which it would be difficult to imagine any kind of market-like process capable of registering a meaningful monetary valuation; for example, the preservation of a beautiful view, historic site or way of life, or the destruction of a unique riverscape.

The ease with which values (benefits and costs) are estimated clearly diminishes as one moves down the preceding list. This is no argument, however, for the policy analyst to ignore values in categories 3 and 4.

General Approaches and Criteria for Resource Management

There are two basic types of resource management decisions: those relating to resource development, such as increasing the volume of water stored or expanding the agricultural or forest land base, and those relating to resource allocation such as allocating a fixed amount of a given natural resource among different uses or users at a point in time.

Such development and allocation decisions must often be made in the context of broad national and/or provincial goals relating to promotion of economic growth, creation of employment, enhancement of trade, greater price stability, a fairer distribution of income and environmental protection. A narrower range of economic criteria, particularly those relating to *efficiency* and *equity* (income distribution), is generally found to be useful especially in appraising the projects or policies of a provincial government department such as Alberta Energy and Natural Resources, Alberta Environment, or Alberta Agriculture.

Efficiency and Equity

The criterion or goal of efficiency deals essentially with the relationship of social benefits and social costs exclusive of their distribution. Any project having net social benefits greater than zero or, alternatively, having a benefit-cost ratio exceeding unity, passes the limited test of economic feasibility. A more stringent efficiency test requires that the project be compared with alternative projects or uses of scarce investment funds.

The goal of equity, on the other hand, refers to the incidence of social benefits and costs – in a nutshell, who reaps the benefits and who bears the costs? Any project or policy typically has impacts on the personal or size distribution of income (among income recipients such as individuals or households), the functional distribution of income (in terms of labor income, profits, and rent), and the spatial or regional distribution of income (say as between northern and southern Alberta).

The Market System and Pareto-Optimality

Economists extol the virtues of price systems as useful, de-centralized, administrative devices. It is also a tenet of economics that a perfectly competitive market system will tend to be efficient. Given the initial endowment of resources, which may be unequal, and given the state of technology, a Pareto-optimal state is achieved wherein total social product – "the size of the economic pie" – is maximized from our scarce resources. Pareto-optimality occurs when there is no way to make one economic agent better off without making someone else worse off, and is associated with a host of marginality conditions in production and consumption.

The concept of Pareto-optimality is of rather limited use as a criterion for public policy. Most projects or policies generate gains to some individuals and losses to others. This led, in the 1940s, to a further refinement of modern applied welfare economics – the "compensation principle" of Hicks and Kaldor. Any project or policy change improved social welfare, it was argued, if the gainers could (hypothetically) compensate the losers and there was some positive net gain remaining. Indeed, benefit-cost analysis rests on these very theoretical underpinnings – the "Pareto criterion with compensation." These refinements are not without criticism. Indeed, Arrow, the Nobel laureate, has argued that it is impossible to aggregate individual preferences into a social preference over various states of the world. Even "majority rule" can be shown not to be an ideal social welfare function. Despite these theoretical difficulties, economists continue to use benefit-cost analysis as a practical tool, and legislatures continue to use the principle of "majority rule."

Market Failure

In addition to not coping adequately with questions of income distribution, the market fails in two other important respects which are of critical importance in matters of resource and environmental management: the presence of externalities and the provision of public goods. Externalities are of two types: (1) external economies – the case of unappropriated benefits, and (2) external diseconomies – the case of uncompensated costs, as in most instances of pollution. Private economic firms or agents will not consider such technological external effects, but such effects are clearly relevant in a social accounting framework.

Nor will private economic forces provide public goods. Public goods have the technical characteristic that their benefits are shared jointly by all users to the point of congestion or capacity limitation. A related, and likely derivative characteristic is that it is impossible, for reasons of technology, cost, or economic efficiency, to exclude a second user once the service has been provided to the first user. Some of the services of public land, for instance, are natural public goods or have been provided as public goods institutionally in cases where the benefits are divisible in consumption and the possibility of charging the user does exist.

The reason why the market fails in matters relating to externalities and public goods can typically be traced back to imperfections in the property rights arena. Garrett Hardin referred to this as "the tragedy of the commons." This phrase, while evocative, can be misleading, as Ciriacy-Wantrup and Bishop pointed out a decade ago (Ciriacy-Wantrup 1985, pp. 25-37). Nevertheless, one is typically dealing with resource depletion where either the resource has no clearly specified system of property rights, as with air, or the resource is a fugitive resource with indefinite property rights, as with fish or game.

Special Rules for Efficient Resource Allocation

I now wish to turn to more specific rules which should underlie resource allocation and which should help to ensure greater efficiency in the use of Alberta's public land and natural resources. Some of these rules were first outlined in a similar meeting in British Columbia by Peter Pearse (1975).

Rule 1: Take a social perspective. In the first place, the policy analyst must take a social, rather than a private, perspective with respect to any project or policy change. Private firms will undertake private feasibility studies which are based on private returns, costs and discount rates. Governments, at times, may only wish to study impacts on their revenues and expenditures. But generally in a study taken from society's point of view, other aspects must be considered. A social benefit-cost analysis, for example, must include external or unappropriated benefits which the private sector can not capture, and external or uncompensated costs imposed by the project or policy on third parties. Secondly, social analysis should consider and estimate the economic activity generated in industries which are linked forward, as with processing and distributing industries, and linked backward, as with input supply industries, to the primary activity such as logging or farming. Such stemming and induced secondary benefits are clearly important to regional income distribution and perhaps also, under special circumstances, to efficiency concerns. Thirdly, there is the distinct likelihood that social rates of discount will be lower than private rates.

Rule 2. Choose an appropriate accounting stance. Is the analysis to be undertaken from the national, provincial, regional or local point of view? Generally, a provincial accounting stance is appropriate because government departments such as Alberta Energy and Natural Resources are charged with managing resources from a provincial perspective and because provincial monies are being used to fund the project. A major implication here is that there may be beneficial impacts of projects on certain regions or communities within the province which would be included as efficiency benefits in a regional stance, but not in a provincial stance. In other words, the inclusion or exclusion of secondary benefits – economic activity which either stems from or is induced by the primary activity – is intimately related to the choice of a suitable accounting stance. Once an accounting stance is chosen, the analyst compares the state of the economy *with* the project with the state of the economy *without* the project, ensuring that any benefit sphere does in fact represent a net gain in economic activity and not merely a transfer of economic activity within the (provincial) jurisdiction.

Rule 3. Value goods and resources properly. For outputs and inputs in category 1 of Howe's classification, market prices do reflect true scarcity values. For such items, the central questions relate to whether the project itself may influence price levels and whether real prices of the item are expected to change over time. For instance, a project which leads to an increase in supply for a particular commodity may reduce its price. Furthermore, the analyst may be expecting that the real price of grain (adjusted for inflation) will continue to fall slowly over the next two or three decades, that the real price of timber, once the current recession is over, may increase slowly, or that the imputed price (value) of scenic amenities will increase over time relative to the price of extractive or fabricated output. For outputs or inputs having distorted market prices (Howe's category 2), such prices should be corrected to reflect true societal scarcity values or opportunity costs. If a benefit-cost study is undertaken, it should be remembered that estimates of total benefits or total willingness-to-pay for project output should include consumer's surplus.

Rule 4. Be sure to consider extra-market values. The social analysis of any project or policy change must consider not only the more readily measured market values. The extra-market values (in Howe's category 3) must be included in the analysis. Benefits and costs in category 4 are not commensurable and must be included as qualitative factors in the overall analysis. A complete and proper evaluation of hydro-electric power from a Slave River Dam, for example, versus power from conventional, coal-fired, thermal production would require inclusion of the respective extra-market costs associated with the two alternatives.

Rule 5. For a natural resource with mutually exclusive uses, allocate the resource to the use which provides the highest net social benefits. If the public land manager, for instance, is faced with the question of whether a particular parcel of land should be allocated to agricultural use or forestry use, the use which provides the highest net social benefits should be chosen.

Rule 6. Where possible, use natural resources on a multiple-use basis. A considerable advance in the societal management of natural resources has occurred whenever single-use oriented government agencies have moved to multiple use of versatile resources. Many forest management departments in North America have historically been criticized for managing public land solely for timber production. This criticism has less validity today as multiple use of forest land has replaced single use in theory and increasingly in practice. The criterion of multiple use, of course, is no panacea in resource management. The criterion cannot be applied to a resource with mutually exclusive uses. Moreover, it gives little indication of the degree to which the natural resource should be allocated to respective conflicting but non-exclusive uses. Economists then go further and employ the principle of "equimarginal value in use." This principle states that a natural resource, so as a parcel of land, should be allocated between two competing uses, such as grazing for cows or habitat for elk, such that the marginal value products of the two respective uses are equated.

Rule 7. Sometimes, no use of a natural resource may be the best use. It is unwise for society to allocate scarce capital and labor to the development of some natural resource if the discounted benefits of so doing are less than the discounted costs–unless there are other over-riding social objectives. Many physical scientists tend to equate the non-use of a natural resource with physical waste of the resource. However, it makes no social sense, at least in efficiency terms, to dam a river or cut a tree, if the benefits of this action are less than the costs.

Rule 8. Be wary of using secondary benefits to justify projects. The problem of secondary benefits has been the most troublesome and controversial aspect of benefit-cost studies, especially those relating to water projects, in Alberta. Economists argue that secondary benefits can only be counted as efficiency benefits within the efficiency analysis if resources are unemployed within the provincial economy and if the spin-off activity truly represents a net gain in economic activity within the province. Prior to 1982, it was clearly improper to include secondary benefits as legitimate efficiency benefits. Today, for their inclusion, the analyst must be convinced that the unemployment of resources would be chronic over the life of the project. Moreover, all projects generate secondary impacts, so a more useful question may be how many more secondary benefits Project A yields than Project B. In general, economists remain reluctant to justify projects in terms of their secondary benefits and would prefer to adjust primary costs of the project, such as labour costs during construction, in periods of cyclical unemployment. This is not to say that secondary benefits are unimportant in project evaluation. Their proper role relates to the objective of regional income distribution as well as to questions of repayment and pricing (Ciriacy-Wantrup 1985, pp. 135-147).

Rule 9. The evaluation and allocation of public goods requires special analytical treatment. It is difficult to impute individual demand curves for the services of public goods. In simulating the demand curves of individuals from direct questionnaires, there are typically biases in respondent's answers to questions concerning willingness-to-pay, either "free rider'' bias or problems stemming from non-representative samples of the population. Once individual demand curves are obtained, the aggregate demand curve for the services of the public good is obtained through vertical and not horizontal summation of the demand curves of all individual users. With respect to pricing of a public good, welfare economics dictates that the efficiency price of a public good should be set equal to zero because the marginal cost of provision to another user is zero.

Rule 10. Avoid irreversibility in renewable resource use. It can certainly be argued that welfare economics and applied tools like benefit-cost analysis do not readily account for the welfare of future generations. In benefit-cost logic, any benefit or cost at some date 30 or 40 years in the future is rather miniscule in present value terms. However, this is not to say that the literature on resource economics is devoid of thinking on matters relating to future generations. In particular, Ciriacy-Wantrup (1968) and Krutilla and Fisher (1975), among others, have argued strongly for strategies in decision-making with respect to renewable resources that would avoid irreversibility (critical zones) in resource use and would ''keep options open'' for future generations. Such strategies are especially important for resources with extremely limited or no substitutes and which are characterized by significant consumer surplus and the existence of considerable option demand. Irreversibly depleting such natural resources can indeed place immoderate social losses on future generations.

Conclusion

The use of economic principles and analysis could play a much larger role in the management of public land and resources in Alberta. In particular, the adoption of the ten rules or caveats outlined in this paper would help to ensure greater efficiency in the development and use of provincial land and resources. Provincial income could thereby be larger and we as citizens would be collectively better off.

REFERENCES

Barkley, Paul W. and David W. Seckler. 1972. *Economic Growth and Environmental Decay*. New York: Harcourt Brace Jovanovich.

Ciriacy-Wantrup, Siegfried von. 1985. *Natural Resource Economics: Selected Papers*, edited by Richard C. Bishop and Stephen O. Andersen. Boulder, Colorado: Westview Press.

Ciriacy-Wantrup, S.V. 1968. *Resource Conservation: Economics and Policies*. 3rd ed. Berkeley: Division of Agricultural Sciences, University of California.

Canadian Society of Environmental Biologists. 1985. *Economy & Ecology: The Economics of Environmental Protection*. Edmonton: CSEB.

Fisher, Anthony C. 1981. *Resource and Environmental Economics*. Cambridge: Cambridge University Press.

Howe, Charles W. 1971. *Benefit-Cost Analysis for Water System Planning*. Washington, D.C.: American Geophysical Union.

Krutilla, J.V. and A.C. Fisher. 1975. *The Economics of Natural Environments*. Baltimore: Johns Hopkins Press.

Mueller, R. Andrew. 1985. *The Socioeconomic Value of Water in Canada*. Ottawa: Inquiry on Federal Water Policy, Research Paper #5.

Pearse, P.H. 1975. "Natural Resource Policies: An Economists's Critique." In *Managing Canada's Renewable Resources*, eds. R. Krueger and B. Mitchell, pp. 14-27. Toronto: Methuen.

Power, Thomas M. 1985. "Economic Valuation of the Natural Environment: Profaning the Sacred?" In *Economy & Ecology: The Economics of Environmental Protection*, pp.37-44. Edmonton: Canadian Society of Environmental Biologists.

Randall, Alan. 1981. *Resource Economics*. Columbus, Ohio: Grid Publishing.

Veeman, T.S. 1985. "Benefit-Cost Analysis in Environmental Decision-Making: Procedures, Perils, and Promise." In *Economy & Ecology: The Economics of Environmental Protection*, pp.129-138. Edmonton: Canadian Society of Environmental Biologists.

QUESTION PERIOD

CHAIRMAN:

Thank you very much, Terry. We again have a few minutes for questions if you'd like to direct them to Dr. Veeman. Would you please go to the microphone, and identify yourself by name and affiliation?

RICK COOK:

I'm with Alberta Transportation. Dr. Veeman, could you give us some direction with respect to two things? One, what sort of timeframe do you think is useful in these economic studies? And secondly, the social discount rate is something like three per cent. Is that more feasible?

TERRY VEEMAN:

Well, your planning horizon is going to depend on the kind of project. Clearly, private firms are going to have pretty short discount planning horizons, as short as five years probably. But from the social point of view, my guess would be something in the neighbourhood of 20 or 30 years. I think if I had to pick a planning horizon it would be about 30 years. Of course, with any positive rate of discount at all, values in the 25th, 26th, 28th years don't assume much magnitude, and that worries some critics of benefit-cost analysis.

With respect to the choice of the social discount rate, I think there are two fundamental questions. One, if you're projecting ahead your benefits and costs in real terms, say in constant 1985 dollars, it is then critical that you use what economists call a ''real'' or an ''inflation-adjusted'' rate of interest and not a nominal rate. Then, when one looks at what level of real interest rate to choose, there are really two competing schools of thought in the economic literature. One is the opportunity cost school looking at the rate of return that could be obtained by those investment funds in either alternative public or private investments. The second school of thought is the so-called social time preference school, trying to judge how society collectively views future benefits as opposed to present benefits. There is no easy reconciliation of those two schools of thought. In a perfect world they're identical discount rates, but in the real world with lots of imperfections they differ. I think my advice would be, start with a discount rate used in much public analysis, maybe five per cent; some of my economics colleagues have suggested higher rates. But I would start with five per cent as a real discount rate and then use some sensitivity analysis around that, try to use two per cent, maybe eight or ten per cent, and see how sensitive your results are to this question of the discount rate. They may or may not be that sensitive. It depends on the project.

PETER NICHOLS:

I'm with Nichols Applied Management. Dr. Veeman, do you see any concern that by the department carrying out a benefit-cost evaluation within its own framework, looking at maybe one alternative resource use versus another, it may sub-optimize a total use of funds in the province if other departments and other parts of the province are not doing the same exercise? In other words, is it possible that in looking at the best use of one area, they look at two alternatives, they say this one is best, and the decision is made to go with that alternative when in fact a better use of public funds would have been perhaps by Alberta Transportation or investing it in widgets somewhere?

TERRY VEEMAN:

Well, I agree. One has to compare projects pretty widely to try to see where the highest social payoff is present. It may be that the two projects that you're comparing, if they're not mutually exclusive, should both go ahead. Sometimes you're dealing with mutually exclusive uses and then you have to choose the best of the two. Then I think you'd choose the one with the highest net social benefits over the timing horizon. I guess it does mean, though, that one is hoping that planning exercises are going on in all units of government so that we start getting a better idea (a long slow struggle) for rates of return involving public land management as opposed to education and health and so on. That's a difficult road I admit, but I would hope that people in the Treasury Department would be fretting a little bit about what alternative rates of return or net social benefits are with respect to alternative uses of investment funds across government departments. So that's a wider responsibility I think of a group like Treasury. You'll want to put your money where you have the highest net benefit. I don't win friends when I go to southern Alberta suggesting that southern Alberta may have better uses of their scarce investment funds than investing it in irrigation expansion. That doesn't go down very well in the irrigation community – and not in a drought year. But these are the questions we've got to ask. Where is the highest payoff to society? Agreed, in some areas those benefits are not easy to measure. When you start trying to measure the outputs of education and hospitals you get into some severe difficulty.

RICK COOK:

Just a quick follow-up to that, how narrowly do you define "economics"? Would you include as part of your evaluation financial analysis, in other words, public sector revenues and costs?

TERRY VEEMAN:

Well, I think it's crucial that government departments do that as well. Private firms will do private feasibility studies. Governments probably should be doing studies of a particular project or plan with respect to their revenues and costs, but I think they are charged with going a step farther in evaluating a particular course of action from society's point of view, which is not only a question of governmental revenues and costs.

LEN FULLEN:

I'm with Alberta Agriculture. Terry, on the way out here this morning I had an article that I have been carrying around in my briefcase for a while and haven't had a chance to read. It talks about the problems inherent in benefit-cost analysis with respect to land-use management decisions. One of the things the author was talking about was your point number ten in keeping your options open. An example that he used, and I'm wondering how we can go about avoiding this situation, referred to when the Columbia River dams were first put in place. Apparently very little value was placed on fish as a means of generating protein because we didn't have a hungry world at that time, supposedly. But looking back on it now there should have been a much higher value placed on those fish. I can see the same thing happening in some of the studies that we're getting into, particularly in agriculture right now. Could you maybe comment on that?

TERRY VEEMAN:

Well, I think that the main point is that one takes a reasonably conservative stance with respect to decisions that have irreversible consequences. I think the case has to be pretty strong that you go ahead with them. I'm not sure that I would never dam the Columbia. That's too strong a position. But you must really look hard and seriously at courses of action that have irreversible consequences, particularly in those instances as I'm indicating where there are few good or close substitutes for the item in question. I wouldn't be so worried about your fish. I think there are alternatives for fish protein. I am worried about other items for which there are very few substitutes. Krutilla has featured them heavily, of course. They are often seen as parts of the natural world which are nature-given, which man cannot duplicate and of which the processes of technology cannot influence the supply. Technology is a tremendously powerful force in terms of increasing the supply of most manufactured and extracted products, but in terms of some of the amenity services of the environment, technology is not a powerful force. In fact, the powers of industrial technology and growth probably erode the habitat and amenity service area. So I think that in one's view about whether or not something is irreversible, one has to look very carefully at the question of whether or not there are close substitutes for the commodity or resource in question. One is less worried if there are passable substitutes. If there aren't, then you get very worried and you try to devise strategies which do in fact keep your options open.

CHAIRMAN:

Again, thanks very much, Terry, for your insight.

THE USE OF ECONOMIC INFORMATION IN POLITICAL DECISION-MAKING IN ALBERTA

by Mr. Stephen Stiles, MLA *

Introduction

In dealing with this topic, "The Use of Economic Information in Political Decision-making", it is my intention to speak first to the political decision-making process in Alberta; second, about the role of the Government of Alberta in resource management; and third, about the use of economic information in this process. I will then address the implications of shrinking government revenues with respect to resource planning.

Decision-Making

I think it's important we understand the kind of process this government employs in reaching decisions. In Premier Lougheed's style of government, he feels very strongly that every elected representative in his caucus should have a voice, and in fact they do. In the Alberta government caucus there is no distinction between cabinet ministers and MLAs. We all sit in alphabetical order around the caucus table. The cabinet ministers are mixed with the MLAs who do not have cabinet roles. Everyone has a voice. I can tell you the Premier doesn't always win when decisions are made. We *vote* in caucus, and that's how decisions are made. If the vote is too close, we have another look at it. But we do vote on the major policy decisions, and that's how they are made. We feel, or at least it's the Premier's feeling, policies made in this way are representative of the mood of the province.

Policies come from the electorate through the elected representatives in three ways. First, they may be developed by the departments and brought to caucus committees by the cabinet minister responsible. Second, they may come to cabinet committees and then to the caucus. Third, individual MLAs will bring policy ideas forward. In every case, a caucus committee and the full caucus will eventually make a decision. We have private member's bills and motions which are a way of introducing ideas the government may not want to try out directly, but which individual members, representing a constituency, may want to bring forth. The idea that a private member could introduce a bill in the Legislature was brought in early in the 14 years the Premier has been leading this government. It not only wasn't done before, it was unheard of. Sometimes, though not often, those private member's bills and motions become government legislation in this province.

---

* Chairman, Alberta Integrated Planning Advisory Committee, Edmonton, Alberta.

We've just come through a leadership convention, as you know, and our new leader will have to evaluate and decide if he is going to continue this system of decision-making. I think I'm fairly safe in telling you he intends to do so. That is certainly my understanding in talking with Mr. Getty. I think he recognizes the advantages of such a system. It certainly means an open government where MLAs are accessible. This type of decision-making is, hopefully, in tune with public opinion. We try to make it that way. Certainly it encourages a free exchange of opinions and ideas. Personally, I'm very pleased to be involved in a government that adopts that kind of process in reaching decisions.

Role of Government

I may have a slightly different perception or philosophy than some of you, and I'd like you to know what representative government really means. I think there are two views of the democratic system of government where you elect representatives. I believe it's a dichotomy you can explain as being Eastern and Western.

The Eastern view of democratic government, which is adopted by most of the Soviet countries, is where a constituency elects a representative who sits in a council of some description and makes decisions on behalf of those people. The Western view, and the one to which I hold, is where an individual is elected by his constituents to represent their views in the council. You'll appreciate there's quite a difference. As elected representatives, we often face quite a problem. In the one sense I represent a constituency. It's my view that I should represent my constituents' wishes, concerns, policies and ideas in the Legislature and in caucus, and I do. On the other hand, I have ideas of my own. My ideas are, I hope, in tune with my constituents' ideas. If they aren't, I'm probably in trouble as an elected politician.

Another role I play is as a member of a government. One of the things that happens to us when we are elected is that we discover it isn't all the way we thought it was going to be. We find there are other concerns we have to address that we hadn't thought about or weren't aware of, and we then have to try to convey to our constituents why what they thought was a good idea won't always work. That task is difficult, but I think it can be easier if we appreciate that our role, as elected people and as a government, is the role of a trustee. Certainly that is the philosophy of this government, and it's certainly been the philosophy of our Premier. We're elected, and Mr. Sparrow often likes to make this point, to serve the people of Alberta. None of us is elected or paid to regulate and control the people. I think it's important to bear this fact in mind when we're looking at our resource planning and management programs.

A good example of the idea of trusteeship was the adoption of the plan to create a heritage savings trust fund in this province. In the early days of this administration, a decision was taken to increase substantially the province's share of the revenues of our natural resource production in the province. I view the royalty share the province takes as a form of rental. If I rent my land, I take a one-third share of whatever's produced because it's my land and I have a capital investment which the operator doesn't have. I see the royalty as being our one-third share of the resource we own. Even though we may not have a capital investment in the resource, it's still ours. I believe the people of Alberta are entitled to that one-third share. It is not a tax, and not under any circumstances could it be considered a tax.

In the 1970s, we were building a surplus of revenue when oil prices were rising and the amount of money flowing in was growing. The present government decided that we didn't need all that money, and it would be appropriate, since oil is a depleting resource, to set some of the revenue aside. Accordingly, we created the Heritage Savings Trust Fund for future generations by setting aside thirty percent of the revenue flowing from the sale and royalty income from oil and gas. The idea of conservation and trusteeship permeates this government's thinking.

Another example of trusteeship, mentioned by Les Cooke, is the Eastern Slopes Policy. The original Eastern Slopes Policy was designed to address the concerns we heard from people who were quite properly horrified at the way in which resource exploitation was going on at a great rate in the Eastern Slopes with no consideration of environmental concerns, esthetics and wildlife habitat. Those concerns were considered important. The Eastern Slopes Policy was adopted to try to stop the spoilage in the Eastern Slopes, and to manage the phenomenal growth occurring in the province at that time.

In 1984 we revised the policy, with some heat. We recognized that perhaps we were a little too negative in our approach. Perhaps it was time now, with the changing economic conditions, to realize that development in the Eastern Slopes was desirable. It was going to do good things for the province. We should be helping rather than standing in the way of development, but still incorporate the fundamentals of protection of the watershed, the environment and the esthetics in place. Now we have a policy that says what may take place, rather than what may not take place.

We believe the role of government should be to identify economic development opportunities for the private sector if it feels they are feasible. In the 1970s, development was going on in the province at a tremendous rate. There was virtually full employment, and there were more things than could be done. People in the government saw things that could be done, that maybe should have been done, but with virtually full employment, nobody was left to do them. So the government started doing some of those things. I don't really have any argument with that, and think it was reasonable and natural. Now, however, we've gone through a period of restraint and are still in a period of unemployment. We are seeing other troublesome economic concerns. We no longer believe the role of government is that of a "doer". It should adopt the role of a "facilitator", an identifier of opportunities, and allow the private sector to invest and be the "doer".

I found it interesting that *The Globe and Mail* picked up on the idea of a market economy. In an editorial yesterday, the paper accused the Government of Ontario of shoving aside the concept of the market economy, and of getting into the areas of housing and labour and not allowing the market system to work. I think this point is worth repeating: "The market economy out-performs any other system now stacked against it in creating wealth, and it is wealth creation rather than redistribution that accounts for the improvement in the welfare of the poor in Canadian society." I think that quote should simply say, ". . . that accounts for the improvement in the welfare in Canadian society over time." Adam Smith would have been pleased to read that editorial because that's essentially what he said. It's the creation of wealth that improves the lot of society. It's the private sector, not government, which will create wealth. From a government point of view, or from an elected member's point of view, we should be finding opportunities for the private sector. In terms of integrated resource planning and management, economics should be considered in that context.

Integrated Resource Planning

As you know, I am the Chairman of the Alberta Integrated Planning Advisory Committee (AIPAC) to the Associate Minister of Public Lands, the Honourable Don Sparrow. The Advisory Committee consists of: the Alberta Forest Products Association, the Alberta Fish and Game Association, the Alberta Wilderness Association, the Canadian Petroleum Association and the Independent Petroleum Association of Canada, (represented jointly), the Western Stock Growers Association, UNIFARM, the Tourism Industry Association of Alberta, the Chamber of Commerce of Alberta, the Coal Association of Canada and the Alberta Motor Association. AIPAC sits as a group of competing interests, looks at the process of integrated resource planning, considers whether the process addresses all their concerns and in particular, asks if it deals with the concerns of the various public interests the members represent. The whole idea of integrated resource planning is a team approach, as Les Cooke mentioned earlier. That team includes both the public and the industry groups which compete for those resources. We have asked the public, industry and public interest groups to become partners in this process. This approach takes longer, as consensus-building always does.

I see two things happening with this integrated approach. In the first place, each of the participants comes to recognize, very early on, they aren't the only ''frog in the pond''. In the second place, once we have produced a plan, the people involved are committed to implementing it. So we've encouraged the people involved in the process to be ''doers'' rather than critics.

Economic Analysis in Planning

How do we use economic information? We found in the planning process, when the earliest plans were getting very close to being completed, that we didn't really know what would be the economic implications of implementing these plans.

I'll use the example of Jean d'Or Prairie. Dr. Veeman referred to it earlier. Jean d'Or Prairie involved a substantial amount of land to be developed for agriculture. When that plan was approaching the cabinet committee stage, we had no idea what the economic implications would be to the government of implementing that plan; what it would cost to put in the road system or the utility infrastructure, what would be the cost or impact of clearing and draining the land and other likely unforeseen costs. We didn't know what would be the cost to the land or to the people bidding on and buying that land. There were other implications. We didn't know what would be the costs or returns to the people who were going to farm that land in terms of the increased distance they would be away from markets, what affect that would have on the profitability of farming, what would be the increased input costs to farm that land. Those are some of the specific considerations we had to address.

The Associate Minister decided that before we would take this plan to cabinet, we needed an economic analysis – an economic impact study. So that study was done. We then realized that it doesn't really have a whole lot to do with whether or not we go ahead with this plan because, after all, the plan addresses whether or not this use is the best one for this public land. Should it be opened up for agriculture, or is there some other use that's better?

We then decided that with plans already in place, or almost in place, perhaps the economic impact study should be applied to the implementation phase so that we wouldn't delay approval of the plan. We approved the plan because it had gone through the process and reflected the best use of the land. The decision was that the economic analysis would have more to do with the implementation of a plan. We also decided that future plans would have to address economic concerns early in their development. That is the reason we're here for these three days and that is the way plans will be developed in the future.

Agricultural Expansion

Another concern I have, and I think we have as a government, in terms of the economic information we want, is whether we should be opening up more land to agriculture? In the Jean d'Or Prairie area we have quite a problem.

There was a tremendous demand to open up land for new agricultural development in Alberta, to make more relatively inexpensive land available. Because the cost of good land in the province has become so high, it really is difficult for a person to buy land, start farming and make a go of it at today's prices.

That fact brings me to the point I'm trying to make. Is agriculture in trouble? You've heard that question in the context of the leadership race we've just finished, and the answer is yes. Agriculture is in trouble, not only in Alberta or North America, but around the world in the developed nations. Incredible as it may seem, we have a surplus of food in the world. That fact raises a very important question for us in Alberta because agriculture represents a tremendously significant slice of our economic pie. While I don't want to get pinned down on the exact numbers, anywhere between 12 and 17 jobs in Alberta stem from each primary producer. If you took agriculture out of Alberta, how many ladies would be employed in the bank in Didsbury? How many people would be employed by the railway? How many people would be working in other jobs that don't necessarily appear to be related to agriculture, and yet wouldn't exist if there weren't an agricultural industry in this province? You have to take that aspect into account.

At the same time, we must consider that if we're going to open up more land to agriculture, we will have to subsidize those producers. Why are we doing it? Why don't we leave the land as it is and let those people do something else for a living? A part of the problem is the fact that farming is a pretty nice way of life. It's traditional. It has to do with family and some of the other values we find important. People want to do it and there's a demand for land. We're not sure if it's economically feasible for people to clear land, drain it, farm it and produce a product they then have to transport over a long distance to get to market; especially when there's a shrinking demand and we may have to subsidize the whole enterprise in the end. We must make those considerations when we make the land-use decisions.

Environmental Considerations

Let me turn now to environmental considerations with respect to the use of economic information. Let's say we're going to recognize, for example, the tourism potential of an area, and suggest that a tourism development of some kind is suitable. If we then say that, because of environmental considerations, we won't allow any development to take place until an environmental impact study is conducted, and we impose the burden of the study on the private sector developer or potential developer, we can place an undue economic hardship on the developer. We had just such an example not too long ago with the Odyssey Project. The demands for impact studies for the Odyssey Project reached proportions so gargantuan that the project finally collapsed because the developer could no longer afford the cost of doing all the impact studies. Rather than realizing a potentially worthwhile project, in some people's view, we deluged the developer in feasibility and impact studies to the point where the project just didn't happen. We can't impose such costs, in the future. We must devise less expensive ways to make adequate environmental determinations, possibly on some kind of cost-sharing basis, or perhaps decide it is the government's role to do those studies and allow the private sector to develop the projects.

Rising Public Costs

The big cloud on the horizon for us in government is the increasing fiscal demands in the areas of social welfare, health care and education. These costs are ballooning on the one hand and on the other hand the revenues are shrinking. As oil prices decline, the problem becomes acute. In the last couple of years, we have, as you know, enjoyed relatively small deficits in our budget. The federal government, for example, is suffocating under a deficit built up over the years, which means that we are really the ones who are suffocating. We don't want that to happen in Alberta. Accordingly, we have to address how we spend money.

Are we going to continue to spend money developing opportunities? In particular, are we going to spend money operating some public facilities? I think we've pretty well come to the conclusion that we aren't. I'd like to give you a "good news and a bad news" example. The Mount Kidd Campground is one of those instances where we put in the capital cost, then invited the private sector to operate it. The private sector is now paying us a rental, so we're recovering some of our capital cost and the operator is making a profit. It's just great! On the other hand, we can't continue to allow park operations from which we collect seven dollars a day for a campsite in our provincial parks, when that fee represents approximately nine or ten per cent of the operating costs. Somebody said that "if government ran crime, it wouldn't pay!"

On the brighter side is the way the Alberta Forest Service runs some campgrounds. My understanding is that they budget about $500 per space per year to operate a campground. If you're thinking in terms of roughly 50 days a year of use, that amount translates into ten dollars a day; that's not bad. I think we could handle it.

The important point to recognize is that governments, generally speaking, do not produce anything. They simply spend money they first collect from the people or from the resources of the province. I think what we're asking you as planners, in terms of the economic factors, is "Where is the money coming from?" The plans we produce in the future must be economically feasible. Each sector of a plan must be economically feasible on its own merits, that is to say, within the parameters of the departmental budgets. It's all well and good to fund the capital cost, but there should not be any long-term operating expense to government. We simply don't have the money any more. We're not suggesting that we would stop funding capital expenses. Obviously we have to build highways and absorb infrastructural costs if an area is going to see any development. Instead, we're asking you to allow the private sector to make those economic decisions. If the private developers see a development opportunity, they have to analyse whether they can make a profit. If they can't, then perhaps we shouldn't be doing it. Maybe we had better wait a while. That's what we're asking you to look at.

The other thing we won't do any more is compete with the private sector. In the future we're not going to build projects which compete with something some individual has built a little way down the road.

Government can no longer be seen as the "quick fix" solution. The challenge to you as planners is to recognize the economic realities of any proposal and develop plans with an eye to economic feasibility.

Conclusion

The purpose of this symposium is to examine the role of economics in resource management. Today we stand at the crossroads since one of the most important economic questions we face is, "Where will the money come from?" As we move into a world in which technology will produce more and more leisure time, less and less human input will be required in the production of goods. We must anticipate a change from producing goods to service-related employment. Where will the dollars come from? Government must face the reality of shrinking revenue and increasing expenditures. We must reassess the role of government as a facilitator and not a doer. We must recognize the private sector. I'm not suggesting for one minute that the private sector is the panacea. Everything can't be done by the private sector. I'm not suggesting it can, but I believe that the private sector, if we allow them, can add an essence of rationality to resource planning and management that we maybe lacked in previous years. That is the hope we have. I think our hope for the future is that government will continue to be a partner, playing a strong role in planning, but also to be a partner in exercising some restraint.

QUESTION PERIOD

CHERYL BRADLEY:

I'm with the Alberta Wilderness Association. You mentioned economic feasibility studies. I'm thinking of them particularly in relation to private sector developments, let's say tourism developments. Let's assume that the developer does an economic feasibility study. By what process is the government going to assess whether the outcome of that study is valid? Although that specific development in that specific place may be economically feasible for the developer, it's going to mean spinoff costs to the government such as putting in communities to house employees for major tourism development. How are we going to assess the real economic feasibility of a private development in the broader spectrum of things? Have you thought that through at all?

STEPHEN STILES:

Well, Cheryl, I believe government has to assess costs to government. For a private sector development on public land, the developer has to do the feasibility study from the point of view of what is feasible for him in terms of its costs. Government obviously has to assess the impact of the development from the point of view of infrastructure costs and what it will get back from that development. As Dr. Veeman pointed out, you go through the whole exercise of benefit-cost and impact analysis and make your decisions. I'm not suggesting that the government should be involved in the economic feasibility study of a project from the point of view of the private developer. That has to be the private developer's role. I was concerned with the cost to the private developer of doing environmental impact studies and those kinds of things.

CHERYL BRADLEY:

Yes, I think I was aware of that point. Environmental impact studies represent a cost to the developer, but there's also a cost to society. I'm assuming that under an economic impact study you're going to have the same cost to the developer and a cost to society, and it could include environmental parameters. I guess I'm just interested in knowing whether integrated resource planning is expected to address those types of questions and at what level.

STEPHEN STILES:

What we're now asking is that planners take into consideration the economic impact and the economic feasibility of what they're proposing in their plans, and that we no longer isolate economics from the plans.

CRAIG TAYLOR:

You spoke earlier about the decision-making role and mechanism used in caucus, how you vote, how you discuss and how people bring in questions. Terry Veeman presented a number of values that people could use, bringing the straight market value down to some other level of traditional value. Obviously, the caucus table has a lot of people around it and they all have different sets of values. Some are a dollar value, some are traditional values, whether it's health, safety, jobs or secondary jobs, as you mentioned. As planners, what kind of information in terms of these values should we be presenting in the plans? Should it be solely market value as straight as possible? Or do we put in values of health, wealth, safety and environmental quality that do not necessarily have a common dollar number?

STEPHEN STILES:

Well, it seems to me, Craig, that when you develop a plan those kinds of values come out in the way a plan is written. I hope we would never see plans without those values included. If you don't incorporate values in your plans, we are not going to pick up those values intuitively as decision-makers. You need to put them in the plans, very definitely.

CRAIG TAYLOR:

Perhaps you and the other caucus members making the decisions don't need tangible numbers to evaluate intangible resources. The value of wilderness can be interpreted without having an economic value established for it. Instead of spending a lot of effort trying to translate a quality environment into one value, perhaps we can present four or five types of values and leave it to the decision-maker to measure whether or not a job is worth ten recreation days of wilderness. It may be just the total that's enough.

STEPHEN STILES:

It's difficult when we get into that whole area of esthetic values. You're dealing with a subjective analysis. The planner can't possibly help but be subjective when he puts in those values, and if he's going to quantify those values, then obviously there are people who will disagree with him. I think all he has to do is note that those values are part of the considerations which determine whether a plan or proposal for an area is good or bad. You have to draw attention to the fact those values are present. What the values are, or whether you rate them high or low on your scale of personal values is another matter, because the people reading that document are going to apply their own subjective value system to them anyway.

WALTER URQUHART:

I'm from the Tourism Industry Association of Alberta. Perhaps a classic view of what happens within the planning process and tourism can be seen in the national parks. I'm referring to Banff and Jasper where Parks Canada, in their planning scenario, are calling for little or no development within the park infrastructure. At the same time, we know that the economic benefits of further expansion within those parks would be of benefit not only to Albertans but to all Canadians. We believe the federal government must derive some form of an integrated planning scenario within the national parks which is beyond the narrow, biased viewpoint of the park planners. Alberta tourism will be promoting a concept where not only the national parks but the Eastern Slopes are considered as a single component for the benefit of all Albertans and Canadians.

STEPHEN STILES:

Thanks, Walter. I agree with you. I'm not suggesting that our process is perfect, but I'm very pleased with the process of integrated planning. Obviously we can always improve on it, which is why we're here this week. Incorporating the economic aspect into planning is part of the improvement. I'm not going to try and speak for what the federal government is doing in the national parks.

THE USE OF ECONOMICS IN RESOURCE PLANNING IN BRITISH COLUMBIA

by: Dr. Roger Reid*

Introduction And Background

In order to appreciate more fully the use and limitations of economic criteria in natural resource planning in British Columbia, it is useful at the outset to give a brief summary of the division of jurisdiction over natural resources among provincial agencies. The agencies with primary responsibility for natural resource management and planning in British Columbia are:

- Ministry of Lands, Parks and Housing
- Ministry of Energy, Mines and Petroleum Resources
- Ministry of Forests
- Ministry of Agriculture and Food
- Ministry of Environment

The resource ministries are represented on the Environment and Land Use Committee (ELUC) of cabinet which is responsible for directing the co-ordination of land and resource-use policies and programs of all ministries and crown corporations[1]. It also resolves issues arising from these policies and programs and makes recommendations to the lieutenant-governor-in-council. This cabinet committee provides direction to the Environment and Land Use Technical Committee (ELUTC) which is composed of the deputies from the ministries represented on ELUC. The ELUTC advises ELUC on matters referred to it by ELUC as well as on the development and implementation of provincial and regional land and resource-use policies and programs of individual ministries and crown corporations.

As is probably evident, the responsibility for managing resources is spread among a greater number of agencies in British Columbia than appears to be the case in many other jurisdictions. One consequence is that greater stress is placed on planning individual resources, and integrated resource planning is not as fully developed as elsewhere. In addition, the emphasis on the use of economic criteria and the techniques used in resource planning differ somewhat from agency to agency. These differences notwithstanding, I think there is a certain amount of agreement among provincial resource economists about the use and limitations of economics at various stages in a resource planning process. The following section sets out the role of economics in natural resource planning, and discusses, based on experience in British Columbia, the constraints that tend to restrict this role.

---

* Senior Economist, Planning and Assessment Branch, Ministry of Environment, Victoria, B.C.

[1] The other three ministries represented on ELUC are Municipal Affairs, Transportation and Highways, and Industry and Small Business Development.

The Role Of Economics In Public Resource Planning

In order to provide a framework for describing economists' involvement in public resource planning, the following list shows the steps that might be followed in a planning process:

1. Assess Current Conditions (use and availability of resources)
2. Outline Expected Conditions (forecasts of use and availability)
3. Analyse Demand and Supply (imbalances over the planning horizon)
4. Describe Management Options (response to demand/supply analysis)
5. Evaluate Management Options
    - (a) Evaluate Resource Trade-offs
    - (b) Redress Resource Losses
6. Select Management Option(s)
7. Implement and Monitor Selected Option(s)

Given this simplified view of a planning process, it is possible to identify the stages at which economists can become involved, and to describe the nature of this contribution.

Forecasting Resource Use And Availability

The first step in a planning process involves collecting and compiling all the relevant information about the present use and availability of the resource(s). This step represents the starting point or basis for making forecasts of what is likely to happen over the planning horizon. Forecasting the future use of the resource is perhaps the earliest stage at which the skills of the economist can make a contribution to the public resource planning process.

Most economists preparing forecasts would stress the inherent dangers. This caution is based on lessons learned from attempts to forecast the behavior of national and regional economies which are monitored very closely and for which much more complete data bases exist than is the case for most resources. Economists forecasting future activity typically employ statistical techniques to extrapolate past trends into the future, modified to allow for any predictable changes in future trends. Events that are largely or completely unforeseen, however, tend to play havoc with any forecast. For example, the OPEC oil price increases of 1973 and more notably 1979, caused a structural shift in the demand for energy and made the forecasts of many utilities appear exaggerated. The danger of unanticipated events changing existing trends in use increases the longer the time horizon over which the forecasts are being made, and the more limited the data on which the forecasts are based. Forecasting is essential in most public resource planning exercises. The planning time horizon is necessarily long, in some cases ten years or more. For example, the planning that leads to a hydroelectric development, a timber cutting plan or the development of a recreational resource such as a park, is based on estimates of expected use that extend well into the future. In addition, the data base for forecasting the use of some resources, especially those that are not marketed, can be quite limited. The greater uncertainty introduced into forecasts by longer time horizons and more limited data should be reflected in broader confidence intervals representing the upper and lower bounds of the estimates. Failure to appreciate the limitations of forecasts can make their use in resource planning more dangerous than helpful.

At the same time as the use forecasts are being prepared, the appropriate experts, be they biologists, geologists, foresters or engineers, should be involved in forecasting future availability of the resource. As in the case of the use forecasts, the forecasts of resource availability must be based on best judgments about future levels of funding, management strategies and technology. It is desirable that the forecasts of use and availability be made simultaneously since the availability of the resource affects the level of use which in turn affects the availability.

Preparation Of Management Options

When the use and availability forecasts have been prepared, they can be compared to determine whether the expected supply will be capable of satisfying the anticipated demand for the resource over the planning time horizon. If the supply at current levels of management is sufficient to meet the demand over the time period, then the analysis need not proceed. If, however, at some point during the planning time horizon, demand is expected to exceed supply such that the resource agency's objectives would not be met, there is then a need to devise management options.

Management options can be categorized as: (1) supply adjustment, (2) demand adjustment and (3) combined demand/supply adjustment. Supply adjustment refers to measures taken to increase the availability of the resource in an attempt to satisfy the expected demand. Measures such as the construction of an hydroelectric dam, the creation of new parks, and fish and wildlife enhancement proposals are all examples of supply adjustment options. Demand management policies are designed to reduce the level of demand, re-direct demand to where there is adequate supply or both restrict and shift demand. More stringent restrictions and regulations on resource use are the forms that such options usually take. The third type of management option refers to situations where the resource supply can be increased but not by an amount sufficient to satisfy the expected demand. As a consequence, it becomes necessary to devise policies that restrict and/or re-direct demand in order to remove the remaining supply/demand imbalance.

Evaluation Of Management Options

Once the management options have been screened for their financial and technical feasibility, economic efficiency is one criterion that can be used to judge the desirability of the remaining proposals. The method most commonly used by economists to evaluate the economic efficiency of project proposals is benefit-cost analysis. As its name suggests, benefit-cost analysis involves comparing a monetary measure of the expected benefits with the costs of a proposed project. In British Columbia, the general principles to be applied in benefit-cost analysis of project proposals are set out in the *Guidelines for Benefit-Cost Analysis*. These guidelines are not intended to cover every possible contingency, but rather provide some common ground for project evaluation. Also, they are not designed or intended as outlines for the application of economics by the uninitiated. Rather, they provide some broad principles for use by economists which mask an array of complex applications.

The value of benefits associated with a proposal is the amount of use it is expected to support evaluated at the appropriate user value. For resources such as minerals and agricultural and forestry products that are exchanged in organized markets, the appropriate user values typically are given by the market prices. Recreational services provided by resources such as fish, wildlife and public parks, however, are usually not traded in markets. As a consequence, it becomes necessary to simulate markets to determine the values that recreationists place on the use of these resources. This simulation is done commonly by surveying users about their willingness-to-pay for the particular recreational experience. These surveys are conducted at the provincial or regional level and produce standard user values that are averages for the province or region as a whole. For example, the BC Ministry of Environment has recently completed reports on large-scale, mail surveys of hunters and anglers. These reports present the average values placed on a day spent hunting and fishing, for the province as a whole as well as for the administrative regions created for managing fish and wildlife. The province has also recently completed a mail survey of provincial residents to determine the value placed on non-hunting wildlife activities. The Parks Branch of the Ministry of Lands, Parks and Housing is contemplating undertaking a survey to determine the value placed on provincial parks. The results would be used to evaluate public park proposals.

A possible shortcoming of employing these user values in assessing management options is that the effects of these options are usually fairly localized and site-specific. As a consequence, user values that portray average conditions over the province or large regions may not be very representative of local conditions. While methods exist to determine site-specific values, the acquisition of new information can be both very time consuming and expensive.

Economic evaluation of management options is complicated further by the fact that the costs and benefits of resource projects continue for a number of years. There are two ways that economists treat dollars spent or received in the future. Firstly, the resources used in the management option could have been employed in an alternative project also capable of producing a flow of goods and services in the future. These goods and services that could have been otherwise produced represent the foregone opportunities to society of the resources used in the management option. The second way of looking at future benefits and costs is that people usually place a higher value on a dollar received or given-up today than at some point in the future. The rate at which the future is discounted, however, is tempered by concern for the well-being of generations to come. Regardless of how the future is conceptualized, it is widely accepted that dollars spent or received in future years should be converted into today's dollars or present values at a rate known as the discount rate. This conversion provides a common and comparable basis for choosing now among a number of projects that may have very different patterns of costs and benefits through future years.

Benefit-cost analysis can be very sensitive to the rate of discount selected. This is especially so in many resource projects where the costs are incurred in the initial years but the benefits are not realized until the more distant future. For example, a silviculture proposal or energy project becomes less desirable the higher the discount rate. Unfortunately, there is no consensus about the most appropriate method for determining the discount rate or the rate that should be applied in calculating present values. Since the selection of the discount rate can be as much an art as a science, it is advisable to attach upper and lower bounds to reflect the uncertainty associated with the rate selected and the sensitivity of the benefit-cost ratio to the chosen rate. For example, the British Columbia *Guidelines for Benefit-Cost Analysis* recommend a discount rate of 10% (presently under review) with sensitivity analysis at rates of 8% and 12%. This discount rate is based on what economists refer to as the social opportunity cost of capital in the private sector. Allowance is made in the guidelines for the occasional use of other discount rates provided they are amply justified.

The use of economic criteria, especially in the form of benefit-cost analysis, has been criticized as having too narrow a perspective to assess resource proposals adequately. Many economists would probably agree with this criticism. Benefit-cost analysis is usually concerned strictly with describing how efficiently a project(s) is expected to provide goods or services. Policy makers, however, may also need to know how a project is expected to affect employment and government revenue and what regions of the province or groups of individuals are expected to receive benefits from the project or to bear its costs. The narrow perspective of economic efficiency can be supplemented by introducing other accounts, in addition to the benefit-cost account, that describe the effects of a proposal on other goals sought by government.

This approach is illustrated by the five-account framework used to evaluate proposals made to the Salmonid Enhancement Program – a jointly-funded, federal/provincial agreement to enhance Pacific tidal water fisheries. The accounts used in evaluating these proposals are:

1. The National Income Account includes all measurable benefits and costs. This account documents the net national income impacts on the commercial, recreational and native food fishery of proposed developments.
2. The Regional Development Account ranks proposals based on a rating system that assigns greater weight to activity taking place in the northern coastal region of the province. The result is to rank each project as high, medium or low in terms of regional development potential.
3. The Native People Account judges the impact of a development on native people based on a number of criteria. These include the effects on the native commercial fishery, food fishery, employment opportunities and the implications for natives in the recreational fishery. Again, a proposal is ranked as being high, medium or low in terms of its effects on native people.
4. The Employment Account rates proposals on the basis of the amount of employment it is expected to support as well as taking account of those who would otherwise be unemployed.
5. The Environmental Account involves a rating system of proposals based on a number of environmental criteria including consideration of stock size, uniqueness, habitat protection, disease potential and mix of stock.

This multi-account framework provides a broader perspective for selecting among proposals. A favorable rating on one or more of these accounts might justify undertaking a proposal that has relatively low net economic benefits.

Evaluation Of Resource Trade-offs

Some of the most troublesome problems in evaluating resource management options tend to occur when proposals made for one resource have detrimental effects on the users of other resources. For example, measures taken to enhance wildlife can lead to damage of neighboring orchards, the protection and enhancement of fisheries can restrict water availability for agricultural irrigation, hydroelectric generation and logging activities can reduce recreational opportunities. Of course, these effects can be minimized by designing management options that are as complementary as possible to adjoining activities. The Ministry of Lands, Parks and Housing in its planning process for Crown land stresses land uses that are compatible with neighboring activities. A series of occasional papers put out by the Ministry of Lands, Parks and Housing spells out the planning and evaluation procedures for Crown land.

Nevertheless, when a proposal is expected to have major impacts on other resources, the full social costs of the project, including costs imposed on users of other resources, should be compared to the expected benefits of the proposal. While the environmental impacts of proposals are examined under the province's environmental assessment procedures, only major developments are, in practice, subject to economic evaluations. This is because these so-called spillover effects are almost inevitable in resource projects and it is practical to analyse only those proposals expected to have major impacts. For example, while all mining proposals made in British Columbia undergo environmental assessments, only three were expected to have sufficiently large impacts on users of other resources to be subject to a complete benefit-cost evaluation.

The attempt to evaluate the external costs of management options is simpler when private property rights are attached to resources. This is because market and legal mechanisms exist which ensure that the full costs of the proposal are made explicit. A management option that leads to a reduction in a forest company's allowable cut or floods agricultural land will bear an explicit cost in compensating the timber license holder or the farmer for the market value of lost production. There is usually no market mechanism, however, to measure the social costs imposed on common property resource users, and only infrequently do legal mechanisms exist which ensure these costs are borne by the proponent. An evaluation that ignores the costs imposed on common property resources, though, can lead to false signals about the desirability of proposed projects and result in the over-exploitation of resources held in common.

A problem that can arise in evaluating trade-offs among resources is an asymmetry in the amount of information about marketed and non-marketed resources. Information about the use and value of marketed resources is usually sufficient to give a relatively full account of the expected effects on these resources. In some instances, though, it is necessary to give a qualitative description of the use and value of common property resources if the methods for evaluating these resources are not developed sufficiently. In such cases, an attempt to perform an economic evaluation can cast the marketed resource in a very favorable light since dollar values can be attached to it.

At present in British Columbia debate is going on over the logging of South Moresby in the Queen Charlotte Islands; an area that largely escaped glaciation in the last ice age and contains an array of distinct and unique flora and fauna. Although it is possible to determine the local timber values it would be extremely difficult to estimate the ecological and preservation values associated with the area. With the present level of information available, this is a case in which an economic evaluation would necessarily give a one-sided presentation of the value of trade-offs among resources.

Redressing Resource Losses

The external costs that management options impose on users of other resources should not only be taken into account in project evaluations, but should also be internalized by requiring the project proponent to mitigate these effects where efficient, and to compensate affected parties for unmitigated damages. This action has the effect of requiring the proponent to take into account the full social costs of the proposal and, in turn, attributes the social costs of producing the good or service to its producers and/or consumers. The objectives of mitigation and compensation are to reduce or eliminate the undesirable impacts of projects during development, operation and reclamation, and to make suitable payments for impacts that cannot be reduced or eliminated efficiently.

Following the dictionary definition, mitigation requires undertaking measures during the planning, construction, operation and shutting down of a project, that would eliminate or reduce negative impacts on users of other resources. For example, forest companies might avoid logging certain slopes where slides might harm fish habitat, wildlife enhancement projects might be planned to minimize damage to agricultural crops, or mine tailing ponds designed to avoid seepage harmful to fish. An economic evaluation of a measure undertaken to mitigate resource losses would require that the value of the resources preserved equals or exceeds the cost of mitigation. If this criterion is not met, society would be better off not undertaking the particular measure.

Again, following the dictionary definition, compensation would require reimbursement by the project proponent for losses that remain after mitigative measures have been undertaken. The amount of compensation that should be paid will be determined by the value that society places on resource losses that remain after all efficient mitigative measures have been undertaken. Compensation should be made initially through "in-kind" payments which require replacing mitigated resource losses with equal values of the impacted resource at, or nearby, the project site. Any program for in-kind compensation should be expected to meet the same efficiency criterion as mitigative measures with the present value of benefits exceeding, or at least equaling, program costs. If any resource losses remain after all efficient, in-kind compensation payments have been made, equity would then require that losers receive monetary compensation.

Not surprisingly, there are a number of problems in attempting to assign liability and assess resource losses for compensation/mitigation claims. In British Columbia, the ability to assign responsibility and liability for external effects is relatively limited and contained in selective regulations and legislation. While there is no general statutory or regulatory basis for assigning liability, many project proponents have shown a willingness to accept responsibility for damage they have caused. Of course, this point raises the question of the extent and value of the liability. While there has been a preliminary attempt to establish guidelines for evaluating resource losses and the resulting compensation/mitigation claims, the guidelines have no statutory force, and use of them has not been followed strictly by all resource agencies. In the limited number of cases in British Columbia where compensation/mitigation claims have been made, economic evaluations typically have represented a starting point with negotiations playing a key role in settling mitigatory and compensatory measures with project proponents.

The Site C Experience

The best illustration of the approach to and problems of assessing a large-scale project and establishing mitigation/compensation claims, is the British Columbia Utilities Commission's (BCUC) review of B.C. Hydro's application for permission to build the Site C hydroelectric generating station on the Peace River near Fort St. John. Applications to the Minister of Energy, Mines and Petroleum Resources for energy project certificates can, with the concurrence of cabinet, be referred to the BCUC under authority of the Utilities Commission Act of 1980 which establishes the process for review and approval of major energy projects. The terms of reference for a hearing (review) are established by the Ministers of Energy, Mines and Petroleum Resources and Environment. The BCUC has authority to recommend to the lieutenant-governor-in-council whether or not an energy project certificate should be issued and, if so, what conditions should apply.

The terms of reference for the Site C review called for the commission to consider project justification based on, among other indicators, social benefit-cost analysis while taking into account environmental, land use, social and economic effects. Public hearings were planned to allow the commission to hear evidence and argument, and to permit public participation in decision-making on major energy projects. In addition to public intervenors, the commission felt it would be important to have input from a number of ministries concerned with the project and its impacts. The ministries submitted "blue papers" setting out the expected impacts of the project on the resources under their jurisdiction and outlining measures for mitigating and compensating for these effects.

During the hearings, witnesses for the ministries and B.C. Hydro presented evidence of the value of resources in the impacted area – with and without the project. Witnesses were subject to cross-examination. In some cases, there was disagreement between B.C. Hydro and the individual ministries about the extent and value of resource losses. The commission weighed the evidence presented and gave its judgment of expected losses. It appeared that B.C. Hydro and intervenors for the resource ministries were satisfied that attempts should be made to mitigate resource losses although there was not necessarily agreement on the best ways to achieve that objective. Some questions arose, however, about the purpose and adequacy of compensation. The commission took the view that resource losses should be compensated in full to ensure that the applicant took account of these costs and to reimburse those who would otherwise bear these costs.

The time and cost associated with the commission's hearing and review procedure has been questioned. Part of the explanation for the delay was the absence of precedents or established procedure for conducting such a review. Also, much of the hearing time was spent examining and cross-examining the conflicting evidence of the applicant and intervenors. The commission recommended that, in order to reduce the time required for the process, intervenors' submissions should be included with the application for an energy project certificate.

Since the Site C experience, B.C. Hydro has gone through extensive discussion and negotiation with the appropriate natural resource ministries about the proposed project on Murphy Creek in the southeastern part of the province. As a result, the hearings for this project should be much more streamlined than was the case for Site C.

Conclusion

In my concluding remarks, I would like to make a few general comments about the use of economics in evaluating resource management proposals. Firstly, I believe, and I think most of my colleagues would agree, that one prerequisite for such evaluations is the existence and acceptance by the relevant agencies of a common set of rules or guidelines, such as the British Columbia *Guidelines for Benefit-Cost Analysis*, to be applied to the analysis of project proposals. The relevant agencies must agree that there are accepted methods for evaluating the benefits and costs of a proposal, and for setting the discount rate or range of discount rates to be applied in finding the present value of future costs and benefits. In the absence of such rules of the game, there may be no common basis on which to judge or compare what might be competing proposals, or to allocate funds among agencies or even within agencies. While a set of guidelines will certainly not remove all controversy or dispute about the appropriate methods of evaluation, it should serve to reduce disagreement. As a complement to the guidelines, it is desirable to have a relatively independent agency to adjudicate any controversies that might arise in application of the guidelines, and apply moral suasion to use them appropriately. While such an agency is unlikely to be willing to comment on the specialized details of resource evaluations, it can be effective in ensuring that the guidelines' general principles are followed.

Secondly, it is necessary to exercise discretion selecting projects or management options that are subject to economic evaluation. The projects selected for scrutiny should typically be major projects or projects having important impacts on other resources. The most obvious reason for being selective is that the number of cases in which economic evaluations could be undertaken is often overwhelming while the number of economists available is quite limited. This reason is compounded by the fact that proper economic evaluations are very demanding in terms of both the amount of information and manpower required. Also, in some instances, projects are sufficiently desirable because of criteria other than strict efficiency, that an economic evaluation is unnecessary.

Finally, the effectiveness of the economist at different stages in a planning process is very dependent on the amount of data available and the development of techniques for valuing resources. The restraints imposed by data and technical limitations are most acute in applying economic criteria to common property resource issues. It may be necessary for the economist to develop a data base describing the amount and value of use of common property resources before being able to undertake any economic evaluations. The development of such a data base can be very expensive and time consuming. Unfortunately, economic evaluations of resource issues cannot be undertaken in any meaningful sense without a full and reliable data base.

Cautions expressed in this presentation are intended to help others avoid some of the pitfalls that are likely to be encountered in applying economic criteria to resource planning and management. Applied in a judicious and professional manner, economics can make a valuable contribution in addressing resource issues.

QUESTION PERIOD

RICK COOK:

I'm from Alberta Transportation. I'm interested in the employment account effects that you spoke of, and, in particular, in Alberta where I've looked at the integrated resource plans produced to date. Something like 60 to 70 per cent of the expenditures by government are road-related. I'm wondering if, at this time of high unemployment in Alberta, it is unfair to look at road expenditures as an up-front cost and say that that's a cost that should be evaluated at the full amount, whatever it costs for the contracts, considering this high level of unemployment?

ROGER REID:

Well, in the case in which there is unemployment, the opportunity costs associated with the labor, with the people being employed in the particular product, takes on a different value than if you were just transferring labor from one project to work on the road projects. So there would be allowance if you're looking at a strict benefit-cost analysis. There would be allowance for the unemployed labor.

RICK COOK:

But you should count certain costs. Is it some place between zero and whatever the contract costs, if you like, of building the road?

ROGER REID:

Yes, yes.

RICK COOK:

Do you have anything between those values that you can give us some guidance for in this economic situation?

ROGER REID:

Are you referring to how you would evaluate the labor?

RICK COOK:

Basically, all right.

ROGER REID:

Well, in the case in which you will have otherwise unemployed labor, then the economist would say that that has zero opportunity cost compared to taking labor that would otherwise be employed on some other project. If the labor were otherwise employed, there is an opportunity cost of employment in the highway project.

RICK COOK:

From a provincial perspective, if we wanted to expand agricultural land or develop roads to recreation areas, could there be, at this particular time, zero costs?

ROGER REID:

Yes, labor costs. I'm sure there'd be some other pretty significant costs.

IAN DYSON:

I'm a resource planner. I wonder if you could embellish your second point with specific examples of the kinds of projects you feel would be suitable to apply the kinds of techniques you've been talking about. The reason I ask this is an interest in the question of scale with which you also dealt. Most of our planning experience has been in a sub-regional context. Within those plans there are all sorts of trade-off conflict situations; the same types of things that you were talking about which will clearly be susceptible to the techniques and methods which you've articulated. But I think the key, and I think you mentioned it yourself, is the resources. It's enormously consumptive of scarce resources in time in order to do this, and yet it would seem inappropriate to say, "Well, these simply fall out of the process, they're not big enough to do it", because cumulatively their impact is extremely significant. I think that's something Mr. Stiles was alluding to yesterday in terms of the impact on the provincial budget. So, I'd like to get some sense, and this will probably come out in the workshops tomorrow in more detail, of where we can get the "best buy for our buck" in dealing with the types of projects and situations we're faced with in Alberta. The co-ordinated land use plans in BC are slightly smaller scale than most of the work we've been doing but are the kinds of situations we're faced with.

ROGER REID:

I guess my reaction would be, first of all, the scale of the particular project you're looking at, i.e. when you say "buy for bucks" or how many bucks are you laying out for the particular project. I mean, it's a very small-scale project and undertaking. It is difficult to come out with some rule to say that above this level you evaluate or below it you don't. Another consideration is that some proposals can be overwhelmingly favorable on other criteria than just the strict economic criteria, i.e. some type of biophysical criteria that you know. Benefit-cost analysis is probably really redundant in such cases. But given the resources you have to undertake economic evaluations and the importance that you attach to the particular project, you must very much play it by ear. It's something, I think, that's quite subjective. Does that answer your question?

TIM WHITEHEAD:

I'm from the Yellowhead Planning Commission. Considering what you said about the limitations of economic data and techniques and a need for some rules of the game, what in your opinion and experience, should be some accepted rules of the game? What would be acceptable at the political level and within the civil service in bringing economics into the planning process?

ROGER REID:

I suppose there are rules of the game established in the form of some type of guidelines, but I think they are something that has to be left to a group of well-trained economists representing the different resource agencies or departments in the government that would be using the guidelines. In terms of limitations, one of the problems we faced in British Columbia is that the jurisdiction over resources is fairly fragmented. Controversy tends to arise amongst some of the agencies about the evaluation of different types of resources when there are trade-off situations. That's why I stress, from our point of view in British Columbia, the need for guidelines which have sorted through and narrowed down the discretion that's permitted in evaluation. That type of problem might not be as serious here in Alberta where there seems to be more centralization of jurisdiction over resources. Does that help you?

TIM WHITEHEAD:

It does. I see a problem with bringing in the economic component. What type of data do you use? At what point can you give it validity? I agree there has to be someone who's going to make up the rules or you aren't going to go anywhere. Even if you have a central body or get together a team of experts with knowledge in that area, what points of validity or what types of data do you feel are more valid than others? I sense that these are some of the rules you were talking about.

ROGER REID:

Actually, the major rule I'm thinking of is more along the lines of a definition of what is considered an economic benefit, an economic cost, discount rates that should be used and finding present values of future costs and benefits. The appropriate data that should be used are very dependent upon the situation you're looking at. In some cases you're looking at marketable resources, and the data are typically readily available and probably on much more solid ground than data describing recreational use of say, fish and wildlife resources, park resources, et cetera, simply due to the fact that the data are determined in exchange. With user surveys, you are usually the one that determines the non-marketed resources and are subject to all the problems associated with surveys.

TIM WHITEHEAD:

I wanted to comment on one of the questions asked on the screening mechanisms. I think this is probably what you're talking about, or what should or should not be included. There's a parallel in Ontario with the Environmental Assessment Act where they used a dollar figure for screening. Certain types of projects that are less than $2 million in value indexed in 1977, which is something over $3 million now, are excluded from the process. They have resisted using environmental significance for the screening mechanism. I personally have problems with that criterion having experienced that, simply because a project is large and might have a large capital cost, many times doesn't relate to its significance or the impact it might have on the environment. A lot of people are struggling with that but nobody has been courageous enough to come up with screening guidelines that relate to significance. It's just a comment on the difficulty of trying to do it.

ROGER REID:

Yes, now I very much agree. That's why I'm hesitant to state any cutoff point because once you state a cutoff point, projects falling below that point can have very serious spillover effects or trade-off effects on other resources and should be screened.

CHAIRMAN:

Thank you very much, Roger. We've had an excellent view from British Columbia.

THE ROLE OF ECONOMICS IN PUBLIC LAND AND RESOURCE PLANNING AND MANAGEMENT IN ONTARIO

by: Dr. Mike Klugman*

Editor's Note: A written paper was not made available by the author for inclusion in these proceedings

---

* Regional Director, Northeastern Region, Ministry of Natural Resources, Sudbury, Ontario

THE ROLE OF ECONOMICS IN PUBLIC LAND AND RESOURCE PLANNING AND MANAGEMENT IN THE UNITED STATES DEPARTMENT OF AGRICULTURE, FOREST SERVICE

by: Dr. John Hof*

The problem at hand is the role of economics, mostly in planning, in the US Forest Service. The two main planning efforts in the Forest Service are at the national level and forest level. National level planning is mandated by RPA which stands for two things. It stands for the Resources Planning Act of 1974 which initiated national planning, and it stands for the documents that emanate from that planning effort, the Resource Program and Assessment. The program component comprises an environmental impact statement. The other major planning effort is at the forest level. There are nine Forest Service regions across the country and within them are 120 forests. They vary considerably in size. Administratively, a national forest is similar in size to the Alberta Forest Service. The National Forest Management Act (NFMA) of 1976, which actually amended the RPA, is the mandate for that level of planning. The documents that emanate from forest planning are the Analysis of the Management Situation, and Draft/Final Environmental Impact Statements.

In national planning, the assessment can be characterized by analysing the resource base (an inventory) of long-term trends in supply and demand, the implications of those trends, the opportunities to manage and use the resource base to make the future situation better, and other general implications. The assessment covers all forest and rangelands in the United States, not just within the forest system. The program is limited to the national forest system, and it's a plan of action to solve the problems identified in the assessment.

Projecting Supply and Demand

The first point for significant economic analysis in this process is the analysis of long-term trends in supply and demand. The RPA planning horizon is 50 years. It's important to distinguish between market goods and non-market goods. The problem is to project supply and demand into the future.

The classic model to do this analysis for market goods is the "Timber Assessment Market Model" (TAMM). It was conceived by Darius Adams and Richard Haynes. Richard Haynes, now in almost complete control of it, is the principal economist at the Pacific Northwest Station in Oregon.

---

* Principal Economist, Rocky Mountain Forest and Range Experiment Station, Forest Service, US Department of Agriculture, Fort Collins, Colorado.

TAMM is a very, very complicated model. It is basically a market-simulation model. It simulates an equilibrium between supply and demand and from that we get a quantity demanded and a price we expect the market to yield. The total supply curve includes the quantity that's produced from the forest system. Thus, we can hypothetically change that quantity in the future and this model can simulate the effect on the timber market from different alternatives of the forest system program. In terms of doing projections with this model, there are market equilibriums in TAMM for both stumpage and final products. There are 47 exogenous variables (supply and demand shifters); for example, the cost of labor and housing starts. Those shifters are projected exogenously, then substituted into the supply and demand functions to yield the equilibrium. TAMM is a year-by-year projection model. It re-equilibrates each year depending on all the exogenous variables and the assumed policy variables that the Forest Service controls.

In contrast, for non-market goods a different structure has been hypothesized in the past. Fred Kaiser and I did the recreation demand projections for the 1980 Assessment. In fact, Mr. Kaiser did the entire 1980 recreation assessment. We modelled recreation demand projections by assuming that the supply of the types of recreation in which we were interested is predominantly on public land. Thus, the supply function is not price sensitive, but can be treated as a fixed inventory. The problem is that the price actually charged is likely to be somewhere well below the demand price associated with the quantity available.

We hypothesized that there is not a strict equilibrating force for this type of non-market goods. The quantities you would actually observe would be somewhere between the supply and demand functions, meaning that the traditional, simultaneous, supply/demand type model was not appropriate. The observed quantity (which we called ''consumption'' instead of ''demand'') is affected by both demand and supply factors, and it's a sustained disequilibrium. Again, we had a number of exogenous variables because our quantity was affected by supply and demand factors. Those variables include income, indicators of tastes or preferences, the usual shifters of demand. Actually, the supply shifter was simply the inventory. We tried approximately 160 different measures of inventories for 23 different activities. The projections are done by projecting the exogenous variables and substituting them into the consumption function. The level of demand generated by the equation indicates an expected level of consumption given those exogenous variables.

I'd like to make two points about these sorts of projections. First, you can't project a level of consumption then try to meet it and expect everything to work the way you predicted. There's a circularity here because supply affects the observed amount of consumption. If we start in 1980 with ten areas and 10000 users per year, we have a carrying capacity or a density of use of 1 000 users per area per year. In 50 years, the projection that assumed no change in supply would say there will be 17 900 users or a density of 1 790 users per area per year. If that is not satisfactory, we could double the number of areas to 20. Then, the projection model indicates that, if we double by the year 2030 the supply that's available, instead of 17 900 users, we'll have 22 200. We will still not maintain the original 1 000 users per area per year density.

Second, and probably more importantly, these projections are simply projections. They don't have any normative content. There's a temptation to project a demand and then to work diligently to meet that demand. That's like projecting the demise of an endangered species and working diligently to make that happen.

This point leads to an important distinction between the anal yses that generally take place in RPA and those at the forest level. RPA tends to be predictive. The economic analyses are generally based on econometric models. The forest planning process, however, is much more prescriptive. Going quickly through some steps, they are:

- identifying purpose and needs
- inventory
- collecting information
- Analysis of Management Situations'' – an initial type of assessment
- formulating the alternatives
- estimating the effects
- evaluating the alternatives
- developing a preferred alternative
- plan approval
- monitoring
- evaluation

FORPLAN

In the Analysis of the Management Situation and in formulating alternatives, the model FORPLAN is used. FORPLAN is an optimization model – a linear program. FORPLAN is actually a matrix generator, an interface to a solution procedure and a report writer. Each of the 120 forests has its own FORPLAN model. All use the same software to build their models, but each model is completely different. The intent of using the same software is some underlying consistency, which has been achieved to a certain degree.

The FORPLAN effort is hard to describe in one respect. I've been told this modelling/planning effort dwarfs everything that's been done previously in economic planning in the Eastern Block European countries. I think that's true. A typical FORPLAN model has perhaps between 20 000 and 150 000 choice variables and between 1 000 and 20 000 constraints. In my opinion it is that big because the problem we're trying to solve is that complicated, not because of an artificial overcomplication.

People familiar with the forest planning process in the Forest Service know we've had some painful moments. You can imagine trying to put up an operations research analysis system in 120 forests on about five years notice – a real challenge to the agency. I think we're actually going to make it!

FORPLAN is used to develop alternatives. We develop alternatives by running different objective functions, putting in different constraints and building models with different management prescriptions. For example, you can build a model that doesn't allow any timber harvesting below culmination of mean annual increment. You can build a model that has extremely intensive management prescriptions. You can build a model that has high targets on timber, wildlife or forage, or all of them. You can also build a model with cardinal weights skewed heavily towards the market goods or the non-market goods.

Actual FORPLAN models are dynamic. They schedule across 150 years, and management prescriptions are included that account for all the different timing possibilities of the actions you want to consider. That's why these models are so big. In a national forest there might be 50 different land types by the time initial age class, quality, aspect, etc. are taken into account. Underneath there might be 20 different management actions to consider. You want to account for every realistic, possible schedule of applying those actions, then account for the schedule of outputs that results. The point is that making the transition into these sorts of analyses on a big scale requires a lot of expertise, a lot of software and a lot of computing horsepower.

IMPLAN

Another model, IMPLAN, is the primary model for predicting economic impacts (employment and income) in the local communities around the forests. IMPLAN is an input/output model. It includes both producing and consuming sectors and models the structure of the economy. IMPLAN is based on a rather large data base. The model will actually build an input/output matrix. Then you can determine multipliers and related information. If a FORPLAN solution indicates, say, an increase in timber harvesting, then IMPLAN could be used to estimate the impact on the local community in terms of employment and income. It was developed by Greg Alward of the Rocky Mountain Station.

Resource Program

I have covered the assessment, but didn't deal with development of the national program in RPA. For 1985, for the first time, the program was built out of regional alternatives. I think for 1990 it will be built out of forest alternatives in a multi-level structure. I'm optimistic this effort will eventually give us some national, comparative advantage (trade-off) information we haven't had before. It may serve as a template for building programs in the future. Now they are simple aggregations of alternatives across regions and forests. To be able to optimize the combinations of alternatives would be an obvious improvement.

So much economic analysis goes on in the Forest Service I couldn't possibly cover it all. Evaluation is a very important problem that hasn't been covered. Obviously, we need benefit numbers to go into the FORPLAN model. We need benefit numbers to do benefit-cost analysis at the national level as well.

QUESTION PERIOD

BRIAN FARDOE:

I'm with the Resource Planning Branch. You mentioned that you did your analysis of demands sector by sector, then essentially amalgamated them. I was wondering how you take into account the varying sets of assumptions each sector makes when they do their analysis. We've had difficulty with that aspect.

JOHN HOF:

Each individual, supply/demand modeller has to make some of his own assumptions. There's a set of basic assumptions that are common in terms of income projections and all the other shifters. The assumptions of what is going on in the actual supply base (what's happening in terms of resource management) are more variable.

BRIAN FARDOE:

I was wondering if you give a statement of common assumptions to the individuals before they begin their projections? You stated there were certain common criteria or assumptions that were considered.

JOHN HOF:

Yes, there are. I don't have them with me. If you have the last assessment, the basic assumptions are listed at the front.

ESSO'S COLD LAKE PROJECT: ITS POTENTIAL APPLICATION FOR INTEGRATED RESOURCE PLANNING IN ALBERTA

by: H.A. (Sandy) Bruce*

Firstly, I'd like to present an overall framework for decision-making in the private sector that includes interactions with both the public sector, formally, and with the general public itself. Then, specifically within that framework, I'd like to go on to talk about the subject of business evaluations, with which I'm most familiar. And I'd like to provide some insight into how the private sector goes about deciding on investment projects. Finally, I'd like to instill a better understanding of why many private sector resource projects take so long to come to fruition. I'm also going to show some typical schedules for various types of projects (Figure 1).

Private Sector Decision-Making

To begin with, I'd like to illustrate an overall framework for private sector decision-making (Figure 2). The main point I want to make with this chart is that the private sector cannot afford to make its decisions in isolation. I believe that fundamentally better decisions are being made today by those companies which appreciate the objectives of governments and the general public. If, in fact, they take these objectives into account, then they are making better decisions. I've listed some of the important objectives of each sector as I see them. It strikes me that many of the objectives are common to two or more of these sectors. The commonality really is more striking than any differences.

I don't want to comment on the entire list, but perhaps it would be most appropriate to talk about some of the private sector objectives. I want to concentrate particularly on the last five. I feel that the better companies in Canada and around the world pay more than lip service to those five objectives. To give you a couple of examples from my own company, Esso Resources, we have fairly rigid ethical standards to which all employees must adhere. Any violations of these standards can result in immediate termination. A second example concerns health and safety. Safety is a stewardship objective in our company. All the line managers are stewards of safety performance both on and off the job. One of our refineries, for example, has the best refinery safety record in the world. We take safety very seriously.

---

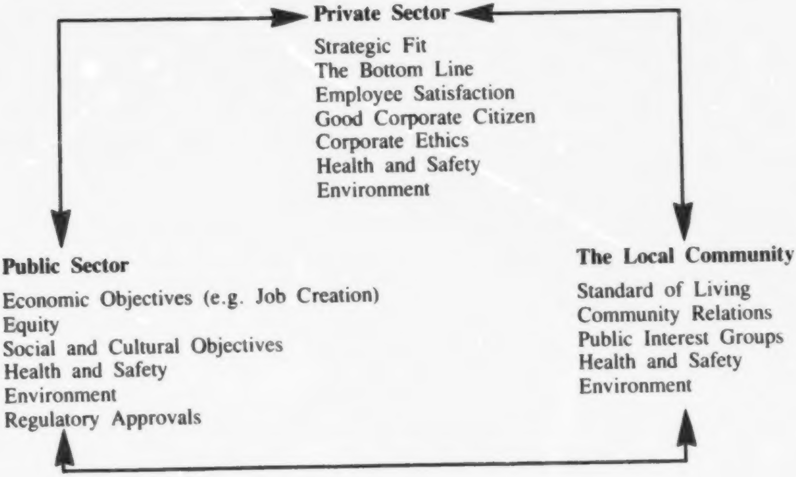
* Economics Section Head, Oil Sands and Coal Department, Esso Resources Canada Limited, Calgary, Alberta.

Figure 1

- An Overall Framework For Private Sector Decision-Making
  - Objectives compared
  - The decision process
  - Dealing with the local community
- The Business Evaluation
  - Purpose
  - Schematic
  - Economic yardsticks
  - Dealing with risk
- Project Timeframes
  - History of the Cold Lake Project
  - Typical schedules for large resource projects

Figure 2

Factors in Private Sector Decision-Making



Private Sector

Strategic Fit
The Bottom Line
Employee Satisfaction
Good Corporate Citizen
Corporate Ethics
Health and Safety
Environment

Public Sector

Economic Objectives (e.g. Job Creation)
Equity
Social and Cultural Objectives
Health and Safety
Environment
Regulatory Approvals

The Local Community

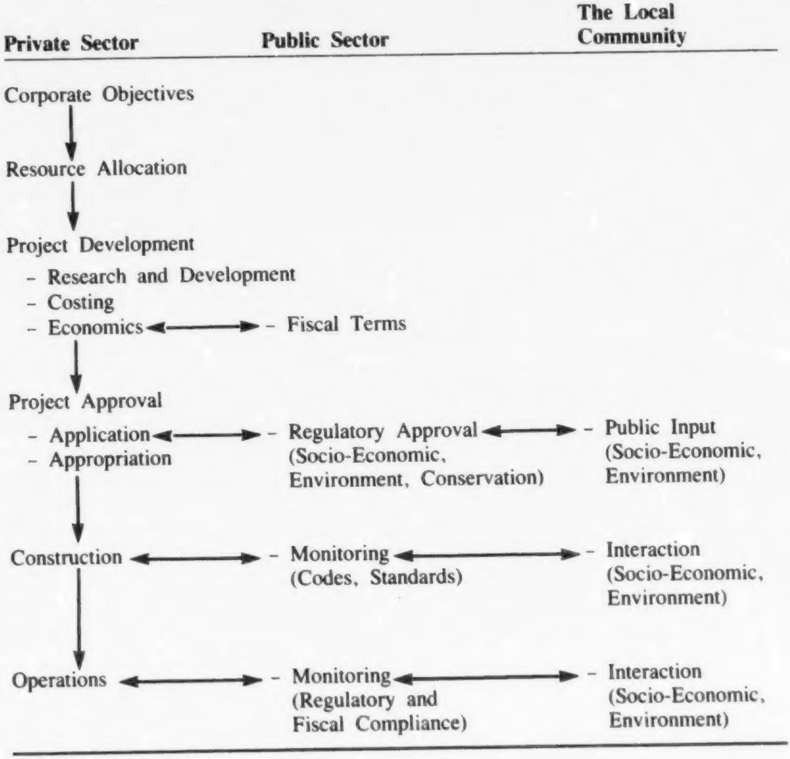
Standard of Living
Community Relations
Public Interest Groups
Health and Safety
Environment

Figure 3 illustrates the process of corporate decision-making and the key interfaces along the way with the other two sectors. Starting with a corporation's overall objectives, many corporations have a formal resource allocation mechanism. It can be by business line, geographic area or a host of other measures. Investment projects flow from this overall strategy and typically begin with a period of research or development, or perhaps with drilling as in the oil industry. After a period that can last many years, business planners join the team and preliminary costing and economics can be undertaken. Depending on the industry involved, fiscal terms may have to be established at this point. This is certainly the case in the non-conventional petroleum sector in Alberta. I'm going to illustrate this process later. If the project makes it this far and still looks feasible, then the formal process of decision-making begins. Regulatory approvals are necessary in resource industries in Alberta and they usually involve a public hearing process. These approvals cover the many facets of resource development – socioeconomic matters, impacts on the environment and so on. Once regulatory approval is gained, the internal decision is made, usually through a formal capital appropriation process. Here all the various factors in the decision are weighed, usually going all the way to a corporation's board of directors. Once a final decision to go ahead is made, the engineering can be completed and the construction and operations phases are implemented. During these last couple of stages the public sector adopts a monitoring role to ensure compliance with various codes and standards. The local community remains involved with the project, directly as employees and indirectly through a number of mechanisms (Figure 4).

Providing accurate and timely information to the general public sounds like an obvious idea. To do it properly really requires a great deal of planning and a fair amount of commitment from senior personnel. Communication is a two-way flow of information, and a company must be in a position to receive and assess feedback from the local community. This task is accomplished both by attending general community meetings, and from frequent contact with community representatives and officials such as elected representatives, local and provincial officials, chambers of commerce, public interest groups and the mass media. The economic benefits that flow to a community can be accomplished by creating and monitoring various content and other targets. The benefits can be accomplished even more directly by proactively assisting local business people. Some of the methods used in this regard include a local hiring preference, implementation of appropriate in-house training programs and breaking up contract bid packages into sizes that can be handled by businesses in the local community. Safety and environment are two important community concerns. Appropriate attention must be paid to implementing and following stringent standards. Above all, companies must be sensitive to local issues and concerns and be prepared to act as required before a minor irritant becomes a major area of confrontation.

Figure 3

Process of Private Sector Decision-Making


Private Sector
Public Sector
The Local Community
Corporate Objectives
Resource Allocation
Project Development
- Research and Development
- Costing
- Economics
- Fiscal Terms
Project Approval
- Application
- Appropriation
- Regulatory Approval (Socio-Economic, Environment, Conservation)
- Public Input (Socio-Economic, Environment)
Construction
- Monitoring (Codes, Standards)
- Interaction (Socio-Economic, Environment)
Operations
- Monitoring (Regulatory and Fiscal Compliance)
- Interaction (Socio-Economic, Environment)

Business Evaluation

I'd now like to turn to the business evaluation proper. A business evaluation is a rigorous quantitative analysis of the financial consequences of a particular investment decision. Figure 5 lists some of the major purposes served by such an exercise. Investment decisions provide for the long-term health and prosperity of a corporation. Some degree of scientific rationality is usually brought to bear on these crucial decisions. Since investment decisions involve long lead times, some element of uncertainty or risk is usually present. A properly done business evaluation can help to highlight and quantify the risks involved. Later I will return to the subject of risk.

Since there are often many alternatives for designing or engineering a project, many engineering decisions have to be made with some rational criteria. We try to help people doing the engineering make sound,

Figure 4

Dealing With the Local Community

Information

- Provide information and receive feedback at open houses and community meetings
  - Employment Opportunities
  - Business Opportunities
  - Development Plans
- Regular contact with
  - Elected Representatives
  - Local and Provincial Officials
  - Chambers of Commerce
  - Public Interest Groups
  - Media

Economic Benefits

- Communicate local, provincial and national content targets
- Implement local hiring and training programs
- Break up bid packages where feasible

Other

- Establish safety standards and programs
- Report environmental impact data
- Be sensitive to local issues and concerns

Figure 5

Purposes of a Business Evaluation

- Provide sound quantitative basis for investment decisions
- Identify and evaluate business risk issues
- Support engineering decisions
- Answer "what if" questions
- Provide input for corporate financial plans
- Support business-government discussions
- Audit previous decisions

---

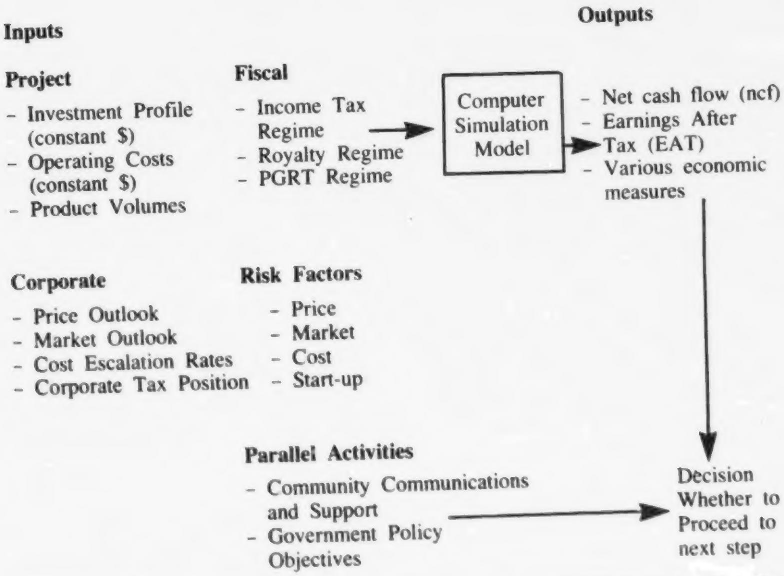
business-like decisions. Management is often interested in "what if" questions. By doing a formal business evaluation, various scenarios of the future can be tested beforehand. One thing that management can do in this area is to put in place contingency plans that can be used in the future should one of the uncertainties actually prevail. A large corporation has many projects at different stages occurring simultaneously. Sound financial planning usually requires some kind of corporate plan that's ultimately brought to the treasurer's attention so that the raising of debt and equity can be planned on a sound basis.

Various government and business interfaces require financial and business information that has a future orientation. The type of business analysis I do plays a key role here. Finally, a corporation run on a solid basis usually audits its decisions and ensures that its business evaluation techniques are sound and lead to good decisions.

Figure 6, attempts to show in a formal way the various steps in the business evaluation. I have divided the process into four components. The most time-consuming and important aspect of the whole evaluation is the preparation of inputs or assumptions. I've, in turn, broken that into four types. Those assumptions specific to the project are usually provided by the engineering or costing groups. Corporate-level assumptions – those sorts of assumptions that are normally common to several different projects – are usually provided by a central authority within the corporation, such as a planning department.

Figure 6

A BUSINESS EVALUATION



Inputs
Outputs
Project
- Investment Profile (constant $)
- Operating Costs (constant $)
- Product Volumes
Fiscal
- Income Tax Regime
- Royalty Regime
- PGRT Regime
Computer Simulation Model
- Net cash flow (ncf)
- Earnings After Tax (EAT)
- Various economic measures
Corporate
- Price Outlook
- Market Outlook
- Cost Escalation Rates
- Corporate Tax Position
Risk Factors
- Price
- Market
- Cost
- Start-up
Parallel Activities
- Community Communications and Support
- Government Policy Objectives
Decision Whether to Proceed to next step

For petroleum industry projects, an important aspect within a model is properly specifying the fiscal arrangements. In many cases, these arrangements are unique to a project, and one has to pay attention not only to corporate income taxes at both levels of jurisdiction but also to specific royalty regimes and the Petroleum and Gas Revenue Tax at the federal level, which is thankfully being phased out over the next several years. Risk factors can be incorporated formally in this kind of scheme by running a number of "what if" or sensitivity simulations. Often, many dozens of these types of sensitivities are explored because of the widespread use of computers in this application. The righthand side of the chart lists some of the outputs or results. Later, I provide definitions of cash flow and earnings.

Figure 7 presents various economic measures in a more formal way. I've listed about ten used fairly extensively in the private sector for making investment decisions. Terminology in this area can be very confusing, and I've tried to avoid as much jargon as possible. The lefthand side of the chart lists those criteria usually used in the context of a full project decision – a "go/no go" type of situation. Actually, far more often we're faced with a situation that is marginal or incremental in nature with a choice of various engineering decisions, mutually exclusive projects and so on. The useful criteria in those instances are listed on the righthand side.

Figure 7

Economic Measures

	Macro Decisions	**Micro Decisions**
Measures	Social Rate of Return	
	Internal Rate of Return (IRR)	Incremental IRR
	- Also known as Discounted Cash Flow (DCF) Return	
	Present Value (PV) Profile	Incremental PV Profile
	Payback Period	
	Financing Requirement	
	Return on Capital Employed (ROCE)	
	Revenue - Sharing - Developer	
	- Alberta	
	- Canada	Benefit - Cost Ratio
Applications	Investment Decisions Fiscal Negotiations	Mutually - Exclusive Decisions Engineering Alternatives Ranking Situations

---

The first measure shown is what I've called "social rate of return". This concept is an abstraction of reality and calculates the internal rate of return of a project as if there were no government sector. The benefit of this step is that it measures the overall attractiveness of the project and indicates at an early stage whether there is enough joy to go around. It is often used in the petroleum industry as a screening tool before fiscal terms are known.

The internal rate of return is perhaps the best known measure around. In private industry we look only at the developer's share of the goodies. We look at the revenue-sharing implications somewhat separately. The internal rate of return is the discount rate that gives a zero present value, or, if you like, the interest rate that accrues in an investment project.

It is often instructive to look also at the present value profile at various discount rates to see how it varies depending on your assumption. There's been a lot of discussion about uncertainty as to the appropriate discount rate. So I think this is a good way to get a picture of how a project's attractiveness varies with the discount rate assumed.

The payback period is the time required for an investment outlay to be recouped from the net revenue of a project. It's very commonly used in industry to assess the risk of a project because many managers feel that the sooner you recover your money, the better. They may well choose a project with a faster payout period over one with a higher internal rate of return.

The financing requirement is the total funds that have to be laid out in order to finance the initial investment in a project. It is useful information for the treasurer's department.

Return on capital employed is the only measure in Figure 7 dealing with earnings or profits. It shows in a standardized fashion how the project will contribute to future profitability.

Finally, I've noted that industry looks at revenue sharing among the developer, the Province of Alberta in this case, and the federal government. This is very important in the petroleum sector as one of the goals in policy-making in the past ten years has been to ensure an equitable sharing of the benefits of a project. The right side of Figure 7 also lists a couple of the measures used in these incremental-type decisions. The two top measures give essentially the same sort of answer as the use of benefit-cost ratio.

Figure 7 deals almost exclusively with concepts that use cash flows. This is very important in investment decision-making. It is the timing of actual cash inflows and outflows that is important in making these types of decisions. Figure 8 compares the concept of cash flow with that of earnings or profits. I thought I should make this distinction because the financial press tends to concentrate on profits or earnings.

Both concepts account for similar types of things. Many of the elements are in fact common. There are, however, two significant differences. Net cash flow accounts for investment dollars as they're spent, whereas the concept of earnings normalizes these expenditures over the expected life of an asset. It does this because an asset provides services over a number of periods, and those services in turn earn the revenue that is reported in financial statements. A charge called "depreciation" is made which spreads the expenditure related to investment over a number of years. The other major difference is the treatment of tax payments. Net cash flow treats taxes as outflows as they occur according to whatever tax legislation in force at the time. On the earnings side, however, taxes are calculated as they would occur if all elements in the

Figure 8

Earnings Versus Net Cash Flow

	Net Cash Flow		Earnings
	Revenue		Revenue
Less:	Operating Costs	Less:	Operating Costs
	Overheads		Overheads
	Investment		Depreciation
	Cash Royalty		Book Royalty
	PGRT		PGRT
	Cash Income Taxes		Book Income Taxes
Equals:	Net Cash Flow	Equals:	Earnings After Tax
Major Uses:	- Investment Decisions - Corporate Financing Requirements		- Financial Statements - Financial Analysis

---

calculation were treated in the same manner by the tax department as they are in the corporation's books. You may have heard the term "deferred income taxes" which is in fact the cumulative difference between these two concepts.

Risk Assessment

I would now like to deal briefly with the nature and treatment of risk (Figure 9). There are many types of risks, and I've chosen those most pertinent to large resource projects.

Hazards are those risks one can normally insure against, such as fire and theft. Business risks, such as price competition and markets, are those most businesses face all the time. They are simply normal facets of a market economy. Using new technology is a risk a number of industries face. The risk or uncertainty is that the cost or performance of the technology is different from what was expected. Uncertain resource base is a risk that is unique to extractive industries and is particularly evident in the petroleum sector. Whether or not oil or gas is present, and in what quantities, is often not known until drilling is completed, or perhaps until well into the producing life of a field. Financial exposure is sometimes a risk. It's a risk if a project is so large relative to the size of the company that the financial performance of the company could be affected by what happens with that project. Finally, the external policy environment can be a source of uncertainty when one looks at projects with lives of 25 years or more. The oil industry in Canada has been through a very turbulent period in the last 10 or 15 years as no doubt most people are aware.

Figure 9

RISK

Types of Risk

- Hazards
- Normal Business Risks (e.g. price, competition, markets)
- New technology
- Uncertain resource base
- Financial exposure
- Political and regulatory environment (e.g. fiscal and policy changes)

Techniques For Assessing Risk

- Judgment
- Sensitivity Analysis
- Decision Trees
- Monte Carlo simulations

Yet

- Many risks remain difficult to quantify
- It usually boils down to a judgment call

The number of techniques for assessing risk run from judgment through to more formal mechanisms. It's probably true that the easiest and least formal ones are probably used most, and the most sophisticated ones are used only occasionally. The sophisticated methods are techniques for generating probability distributions associated with the measures of interest as opposed to coming up with a singlepoint estimate that the expected return on a project is 'X'. Rather, you get a probability distribution of the return. In Monte Carlo simulation, often thousands of cases controlled by probability distributions are run, and an overall distribution of the interest outcome is generated Despite the widespread availability of such sophisticated techniques, many risks remain difficult to quantify. In industry, most decisions are made on the basis of judgment calls.

Figure 10 shows an example of a business risk with, in this case, a favorable outcome from the point of view of the oil industry. This concept of risk or uncertainty really speaks to both upside and downside events. Figure 10 shows typical oil price forecasts made at various dates in the past for the year 1980. Ten years before the fact, the forecast was five dollars a barrel. As late as a couple of years before the fact, it was 20 dollars a barrel. The actual price in 1980 was 29 dollars a barrel. Of course, prediction errors are made in both directions. Predictions made five years ago concerning oil prices today were considerably higher than the 28 dollar level that currently prevails in world markets.

Figure 11 shows in a conceptual way the relationship between risk and return. The vertical axis represents one of the return measures, while the horizontal axis represents a measure of risk such as the standard deviation of the expected return. If there was no risk involved in the project, the required rate of return of that project is shown on the vertical axis where it's labelled "risk free rate". Projects with an expected return greater than this rate would be accepted and those with a lesser rate rejected. As project risk increases, so does the return required to compensate the decision-maker for the greater risk. The solid line divides that area where projects would be accepted from that where they would be rejected.

Figure 10

The Hazards of Forecasting

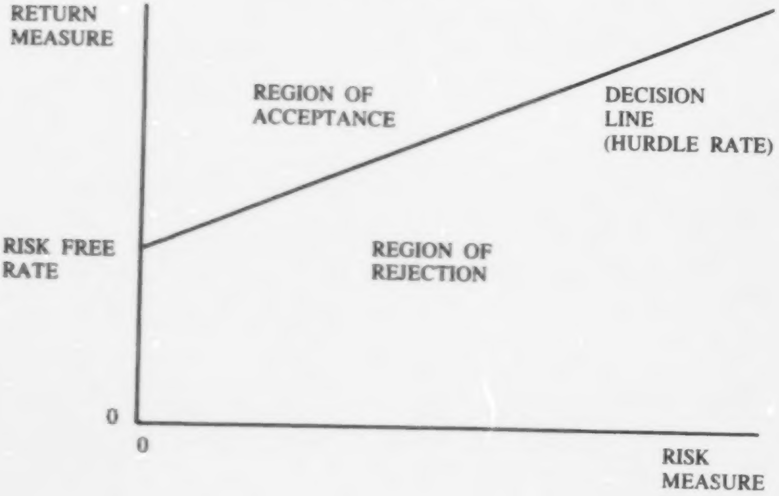
- Typical crude oil price forecasts for the year 1980:

Date of Forecast	Amount
Early 1970s	$ 5/Barrel
Mid 1970s	$15/Barrel
Late 1970s	$20/Barrel
Actual	$29/Barrel

- Ex ante projections can be very wide of the mark.

Figure 11

RISK VERSUS RETURN


RETURN MEASURE
REGION OF ACCEPTANCE
DECISION LINE (HURDLE RATE)
RISK FREE RATE
REGION OF REJECTION
0
0
RISK MEASURE

Project Timeframes

For a specific example of these principles, Figure 12 shows an abbreviated history of the efforts Esso Resources has made in the Cold Lake, Alberta area. It shows that we have spent over 25 years bringing this area into commercial production. We began acquiring oil sands leases in the area west of Cold Lake in the late 1950s. After undertaking some initial exploratory drilling, we felt we had something worth taking to the pilot stage. In 1964 we commenced pilot recovery operations on a very small scale at the so-called Ethal Pilot, which has since been abandoned. Our results from that effort, however, were encouraging enough to go a little bit bigger. The next step was the start-up of a pilot plant (May Pilot) which produced approximately 1 000 barrels a day in 1971, is still operating and is presently being expanded to a production level of around 3 000 barrels per day. Four years later, farther north on our leases, we started the Leming Pilot at a level of about 5 000 barrels a day. The specific production technology we are using in our current commercial projects was first tested at Leming. Extensive experimentation continues at this site today.

Having started that fairly large pilot operation, we felt we were in a position to go commercial. In 1977 we announced a commercial project for Cold Lake and filed an application with the Energy Resources Conservation Board (ERCB). This was the so-called mega-project with a bitumen production rate of 160 000 barrels a day – a vast size by any standards. It represents about 10 per cent of Canada's oil consumption. At that time we proposed to upgrade the bitumen to a synthetic crude oil suitable as refinery feed-stock. After an extensive review and a major public hearing, the ERCB approved the Cold Lake project. For a number of reasons including lack of fiscal terms, falling world oil prices and high cost inflation, the mega-project was suspended in mid 1981. This led, at Esso, to a period of rethinking concepts. Eventually, we devised the concept of phasing, where we would undertake development in a staged fashion in order to minimize the risk and financial exposure. In June 1983 we filed another application for the phased project, proposing specifically to undertake phases one and two. These phases are sized at a level of approximately 20 000 barrels a day of bitumen production, and there's no upgrading involved now. We have since applied for four further phases, and, in fact, the first shipments of diluted bitumen from our project occurred in July of this year. Daily production rates have since exceeded 25 000 barrels a day from phases one and two. Phases three and four are currently steaming and shipments are expected by year-end. By the end of next year we should be producing around 75 000 barrels a day in total from the Cold Lake pilot and commercial operations.

While I can't claim to be the original author of Figure 13, it gained fairly wide circulation within the company in 1981 when the mega-project was suspended. One of the great challenges in running a large project team is keeping up morale. I can testify that things looked pretty dark in 1981. Approximately 500 people were working on the engineering of the project at that time. Happily, better times have prevailed and we're back at the enthusiam stage in Cold Lake.

Figure 12

HISTORY OF THE COLD LAKE PROJECT

Late 1950s – Began acquisition of oil sands leases

1964 – Commenced pilot recovery operations

1971 – Start-up of May pilot (1000 b/d)

1975 – Start-up of Leming pilot (5000 b/d)

1977 – Commercial project announced and ERCB application filed

Oct. 1979 – ERCB decision report issued

Apr. 1981 – Start-up of Leming expansion (14 000 b/d total)

July 1981 – Commercial project suspended

June 1983 – ERCB application filed for phased Cold Lake project (phases 1 & 2)

Mar. 1984 – ERCB application filed for phases 3 & 4

Jan. 1985 – ERCB application filed for phases 5 & 6

July 1985 – First commercial bitumen shipments from phases 1 & 2

Figure 13

SIX PHASES OF A PROJECT

- Enthusiam
- Disillusionment
- Panic
- Search for the Guilty
- Punishment of the Innocent
- Praise and Honors for the Non-Participants

Figure 14 illustrates the typical timeframes that might be involved in a medium-sized, non-conventional oil project. It could also represent perhaps a medium-sized, heavy-crude, upgrading project or in fact a refining project. The timeframe runs from the time that piloting or demonstration has proven the technology and a commercial project is judged feasible. It might be surprising that the largest, single, major stage is the first one, planning and feasibility. It can take as long as five years. During this stage the basic project parameters are established: size, schedule, execution plan, site plan and the processes to be used in production and processing. The economics of the venture are also established at this point with fiscal negotiations taking place if necessary. Another activity, with public sector interfaces, is the regulatory approval process. Once all these matters are settled, process design can begin. The engineering of the project is developed from the conceptual level to the detailed specification of what is required in each unit of the process. As well, final costing, scheduling and execution planning are undertaken.

One or more engineering, procurement and construction (EPC) contractors are selected to build the project and detailed engineering begins.

Figure 14

TYPICAL SCHEDULES – LARGE RESOURCE PROJECTS

STAGE	TYPICAL TIME FRAME	EXAMPLE ACTIVITIES
Planning/Feasibility	3 - 5 years	Screening Studies Process Selection Fiscal Agreements Regulatory Approvals
Process Design	1 - 3 years	Design Specification Definitive Cost Estimating Contracting
Detailed Engineering	2 - 3 years	Detailed Design Procurement
Construction/Start-up	3 - 4 years	Fabrication Installation Training Commissioning
Less: Overlap in Schedule	(2 - 5 years)	
	7 - 10 years	

- Highly dependent on project size, location, political and business climate and degree of innovation involved.

The blueprints are drawn at this point and procurement of materials and machinery begins, as does site work. The construction phase is next, with fabrication and installation of the facilities. Long before start-up, hiring and training of operations personnel begins to ensure an efficient commissioning period. Commissioning itself can take a couple of years, or more, for very large projects. Because a number of the activities shown in Figure 14 overlap to some extent, I have subtracted an estimate of the amount of overlap. The bottom line shows that it takes something in the order of seven to ten years to go from planning and feasibility through to start-up of a medium-sized resource project. Where a project falls in this range is, of course, highly dependent on project size, location, the political and business climate and the degree of innovation in the technology.

One of the unusual things about non-conventional oil projects is that the revenue-sharing arrangements are not given but must be negotiated on a project-by-project basis. The Department of Energy and Natural Resources has the responsibility for negotiating such agreements in Alberta. These negotiations are held also with the federal government, represented by Energy, Mines and Resources (EMR), in either a parallel or tripartite arrangement. Figure 15 illustrates in a general way what is involved in fiscal negotiations. The operator first prepares economic studies of the project from the various feasibility studies that have been done. If partners are involved, the operator will review the economic runs with the associates. This information is then shared with both

Figure 15

STEPS IN FISCAL NEGOTIATIONS

STEP	TYPICAL TIME FRAME	EXAMPLE ACTIVITIES
Preparatory	1 - 6 Months	Prepare economics from feasibility studies Review with associates Meet with governments Calibrate models
Negotiate Agreement in Principle	6 - 24 Months	Case running Technical meetings Negotiating meetings Agreement drafting
Negotiate Definitive Agreement	6 - 24 Months	Negotiating meetings Agreement drafting Execution
	13 - 54 Months	

governments in order that all parties are able to calibrate models of the project's economics. Until such a calibration is established, you're normally not going to go very much further. Once this is done, however, negotiations can start in earnest. A typical approach is that all parties to the negotiations will establish some negotiating objectives and share some cases with the others. Hopefully, after a certain period, reasonable consensus will emerge and an agreement in principle can be drafted for higher-level review. If this stage is concluded successfully, the lawyers can begin to hammer out the details that make up the final binding agreement. This last stage can take as much time as the previous one if there are few precedents.

Conclusion

In conclusion (Figure 16), I believe that the objectives of both the public and private sectors can be mutually accomplished. In many instances the objectives are much the same, and a win/win solution can be achieved. This whole process can be facilitated by close co-operation among government, industry and the local community. In this way, potential problems can be resolved early while they are small, which is better than confrontation later, after hardening of positions.

Figure 16

CONCLUSIONS

- Public and private objectives (often the same) can be mutually accomplished
- Close co-operation among government, industry and the local community is essential
- Early resolution of potential problems while small, is better than confrontation based on hardened positions

QUESTION PERIOD

CRAIG TAYLOR:

We hear in Alberta and in the federal government now that there's a general change in attitude toward the private sector to encourage it to do most of the development, keep government down, change regulations and that type of thing. That, from what you've identified, reduces your risk in projects and your evaluation. My question is, how do you deal with regulations and explicit policy; how do you deal with a general attitude, an attitude change, in your risk analysis?

SANDY BRUCE:

Well, let me comment, first of all, that I was encouraged by many of the words I heard yesterday. You're quite right that certain regulations and legislation pin down the political climate in brass tacks. I believe that a climate change of a more generalized nature is going to take longer to be recognized by the private sector. It's really a question, I think, of perception rather than fact. I certainly would encourage the public sector to maintain a steady course. It may take a couple of years to get the message across. I think it eventually will.

CRAIG TAYLOR:

One supplementary question. I wonder if your description indicated that payback was obviously related to risk? As the risk went up you expected a quicker payback period on any investment that a private sector might make. Would it be encouraging from the government's point of view? Often, longer-term projects have longer implications that are better for the community, for the province, for Canada in total. Again, if we can reduce the risk for companies, there is more chance to get longer payback periods and, therefore, to reduce risk to your operations.

SANDY BRUCE:

If I understood the nature of your question, and I'm not sure I did, I think we should distinguish between the sorts of risks that the private sector faces and those that the public sector faces. I believe that the payback period should be a less relevant criterion for public sector decisions because the nature of risk is somewhat different. To give you an example, the public sector's projects are more numerous. If the risks of one project are largely independent from the risks of another project, then there's a certain certainty, if you like, in diversification. So I don't believe that the payback period is an indicator that should get high priority in the public sector.

GERRY PROTTI:

I'm with the Economic Planning and Financial Analysis Branch in Energy and Natural Resources. We're responsible for conducting the project evaluation, and the policy and financial analysis of these major projects. I have a comment on your last, or second last chart, where you show a time period of 13 to 54 months for the start-up and the negotiating process before you reach a definitive Crown agreement. I think it's important to note that the majority of in situ projects that we're looking at now are very much at the lower end of that spectrum. We've had in the last couple of years a number of projects that have moved very quickly from the initial planning stages through a draft agreement to a definitive Crown agreement. The projects taking longer are the major ones like major mining projects. The length of time required is in the order of three or four years. There's an equal sharing of that lag, I would argue, between the government and industry where very often it's industry reassessing its own risks and spending a considerable amount of time doing those individual risk analyses before coming back to government. So I didn't want the impression to remain that that was a government regulatory lag.

SANDY BRUCE:

I hope I didn't give that overall impression. The purpose of those various charts was to try to give you a better feel for why things take so long. I agree that the lag depends on both negotiating parties.

ADDRESSING THE SOCIAL AND ECONOMIC IMPACTS OF INTEGRATED RESOURCE PLANNING

by: Professor Douglas R. Webster*

We can be sure of two things in undertaking integrated resource planning. The first point is that no matter how hard we work, the plan will be sub-optimal. Given the complexity of the human social and economic environment, the chance of developing an optimal plan, in the true sense of the word optimal, is probable one in 50 trillion. Secondly, no matter what is implemented, someone or some group will be relatively and/or absolutely worse off than they were before. If everybody is perfectly happy after a plan has been implemented, nothing has changed. Integrated resource planning is a ''messy business''. It is an activity that involves considerable human judgment and will necessarily, yield a sub-optimal result.

Methodologies and Techniques

Other papers in these proceedings have dealt with various methodologies useful in integrated resource planning. It is much easier to talk about these methodologies than to operationalize them. I have yet to meet someone who disagrees with benefit-cost analysis in its idealistic and theoretical sense. Who could be against doing something which improves the welfare of the world? The problem, as we all know, is that there are many impacts that can not be measured, externalities, et cetera. This problem is so serious that, for example, the World Bank, which is a ''true believer'' in benefit-cost analysis, does not undertake such analyses on many types of social projects, such as education and health projects. In these cases, the World Bank tries to work toward a certain set of goals in the most cost-effective manner.

Similarly, the other generic set of methodologies resource planners often talk about, socio-economic impact assessments, also presents the problem of trying to measure outcomes which are very difficult to quantify. Deciding what to measure and how to measure it will obviously very much affect the outcome. Rather than using money as the medium all the time, it may be better, in some cases, to try to measure human welfare more directly. For example, we could measure human welfare in terms of the health of people affected, employment created, kinds of jobs created, and who in terms of societal sub-groups is getting the jobs. In other cases, money as a medium is probably the best measure; it does afford the advantage of comparability.

---

* Director, Urban and Regional Planning Program, Faculty of Environmental Design, The University of Calgary, Calgary, Alberta.

The world is undergoing a period of structural change. Unless analysts can somehow accurately forecast the price of specific goods, commodities and services relative to other goods and services, we have a problem with benefit-cost analysis and related methodologies. Similarly, unless we can forecast values we also have a problem because the value system of a society determines the real importance or meaning of various outcomes. For example, amenity services and good landscapes for tourism are likely to acquire more value in the future. Unless we can address these structural changes in taste or value, a lot of the techniques we have been discussing, which are essentially static, are limited in their usefulness.

As we know, resource regions are notoriously affected by exogenous factors, much more so, for example, than most metropolitan areas. Resource regions in western Canada are no exception. Their economies are essentially demand-sensitive. That is, demand for the primary commodities determines, to a considerable extent, the economic and social well-being of these regions. Demand is normally determined outside western Canada, indeed outside Canada and often outside North America. Any modelling done or any techniques used are only as good as the human judgments put into them about the future. When considering methodologies and techniques relevant to integrated resource planning, including econometric modelling, it is essential that we realize there is a good deal of futures-analysis that must go into this kind of work.

I want to deal with some of the conclusions that emerged from a University of Calgary seminar last year on the work Alberta Energy and Natural Resources is doing in integrated resource planning. I have identified seven points, some of them very similar to the issues Dr. Veeman has addressed.

1. The first point is the need to internalize economic and social factors in the actual plan-making process rather than handling these factors using a "cash register" approach where benefit-cost analysis or socio-economic impact analysis is done after the plan has been finished. The time has come to internalize these important factors into integrated resource planning. Methodologically, an approach based on internalizing socio-economic factors creates some serious problems I will address later.
2. Do you do economic or financial analysis? Dr. Veeman dealt with economic analysis, that is, analysing and making allocation decisions from the point of view of the welfare of the world. Financial analysis involves looking at a problem from the point of the view of the corner store, the government cash register or the farm; in other words, from the point of view of the producing entity, the local or provincial governments and at the regional scale. Financial analysis should complement economic analysis, not replace it.

In integrated resource planning, one needs to be concerned with both concepts. The case for economic analysis has been well made by Dr. Veeman. I would argue that governments, private enterprises and public enterprises need to know the costs of resource initiatives to them. Will a given initiative make a profit or will it have to be subsidized? If an initiative does not break even, does it have other redeeming social or economic qualities?

3. Point three deals with the question of scale. I have a bias, because of training in regional economics, toward the region as an important geographic unit for analysis. Dr. Veeman made the case for the provincial scale. Many actions of governments throughout the world are designed to improve welfare at the local or regional level. In many cases it is very important to be able to measure, at the regional level, employment, income and value-added or more direct measures of human well-being, such as health-related indicators. The sub-provincial region should be one of our accounting stances. This position creates some methodological problems and questions of value in trading-off benefits and costs to the region vis-a-vis larger spatial units.

   A report by Stewart, Weir and Co (1984) indicated benefits in terms of employment, income, et cetera, to the Jean D'Or Prairie region. At the same time, the provincial government would have to subsidize agriculture and infrastructure to create these benefits. In this and many other cases, a benefit at the regional scale is a cost at another scale – provincial or federal. In other words, many of the benefits (and costs) are transfers from one region to another. Benefits, however, are real to the people of the region in question. I always ask my students, "if there are many unemployed people in a town and a new firm comes in, should the local unemployed or the inmigrants receive the new jobs?" They always say the local people should receive the jobs. But if we are looking at the situation in a purely regional financial sense, it is better for the local people not to receive the jobs. They stay on unemployment insurance or public assistance which are transfers to that region, and a new set of inmigrants earns money from the new firm, adding to the income of the region. In summary, what is a benefit and what is a cost depends on where the lines are drawn. If boundaries are drawn around the whole world, everything becomes an internal transaction.

   The use of provincial boundaries in economic (benefit-cost) analysis is incorrect technically. In economic methodology, border pricing should be used. In other words, if something can be purchased less expensively at the international border, that price is the economic value of it. Normally, this price is set by the world market price of a commodity. If provincial boundaries are used for economic analysis, however, is border pricing then based on the Alberta border or the international price?

4. Planners should not master-plan when undertaking sub-regional, regional and provincial planning. The regions are too complex and the future world is too unpredictable to master-plan. What is needed is a *set of guidelines* to enable a region to cope with future changes.
5. Point five on this issue, and there may be some disagreement on it between the Government of Alberta and myself, concerns what I perceive to be a lack of social content in the work being done in integrated resource planning in Alberta. Social analysis consists of three components. One is the value component, which the politicians and their constituents bring into the process. Mr. Stiles dealt with this aspect. The second component might be called the social process or participation component, being done to some extent in existing Alberta integrated resource planning. The third is substantive social analysis of the society in the regions being planned and how it is impacted by the plans being prepared. Very little substantive social analysis is being undertaken as background to these plans.
6. Point six addresses the discount rate problem discussed at length in earlier papers. The discount rate bias affects forestry in particular. As we all know, with any realistic discount rate, a benefit 25 or 30 years into the future is of virtually no economic value. Projects and programs such as multiple land-use analysis, can be designed to help circumvent this problem. This creates the situation of the "tail (methodology) wagging the dog (strategy)." Nevertheless, using a traditional methodology, such as benefit-cost analysis, creates a bias against activities such as forestry where the payoff is very far into the future.
7. The seventh point that emerged from our discussions in Calgary was the question of incrementalism. What is incremental? On first reading, it seems obvious that anything new proposed in a plan should be deemed incremental. Operationalizing this concept, however, is much more complex. For example, if an area is being used for wilderness purposes and, in all likelihood, it will continue to be used that way, and then a plan is implemented that guarantees continued wilderness use, is that an incremental type of activity or not?

I want to discuss the question of differences in methodology with changing spatial scales. There is a hierarchy of planning regions for integrated resource planning in Alberta. Mr. Cooke has described this hierarchy.

At the sub-regional level, where most of the work has been done, plans can be disaggregated into a set of projects or quasi-projects. At that scale, the analyst can often use the conventional methodologies such as financial and income analysis and benefit-cost analysis. Also, the analyst can discuss directly the plan or initiatives in it with the people being impacted. They will be concerned about what is planned because they will be geographically close to the results. I would advise, at this scale, to use employment indicators in your work rather than indicators such as the value of production or value-added because there are very large leakages from small, regional, resource economies. A study by Fairbairn and Ironside (1973) of the University of Alberta on the economy of the Peace River region of northern Alberta, indicated that approximately $9 of every $10 of the value of production of the oil industry left the region on the first round. There are lesser leakages in other industries, such as tourism. At the sub-regional scale, fiscal impacts on the local and provincial governments should be identified and related to the initiatives proposed. Who is obtaining the employment created is another important consideration at the sub-regional scale – local people, unemployed people, women or natives?

An entirely different set of socio-economic methodologies apply at the regional scale, namely regional economic techniques. It is important to understand how the region in question functions as a socio-economic entity. When new initiatives are considered at the regional scale, they should be analysed in a more indicative and generalized manner, almost in a generic fashion. For this reason, techniques such as industrial-complex analysis, industrial-mix analysis, location-quotient analysis and occupational-mix analysis would be relevant. In many cases at this scale, using a generic approach – that is assuming, for example, that all pulp mills have certain common generalizable characteristics in terms of impact – would be the most suitable approach to use rather than trying to analyse each initiative in the plan as a specific project. This approach becomes especially useful as you mix projects, or modules or "building blocks" in different combinations and permutations in developing a regional plan.

Socio-Economic Analysis and the Planning Process

I wish to address now the question of internalizing socio-economic analysis in the planning process. Achieving this goal obviously necessitates having on the planning teams a person(s) who understands this field while formulating the plans. You must either hire these people or have them available in a resource capacity to work with while you are preparing the plans.

In creating the plans, it is essential to have a process that tests different permutations and combinations of initiatives or modules. These modules can be formulated in terms of either land uses or projects. For example, a planner can compare a scenario containing a pulp mill with "X" production per year with a scenario involving no pulp mill but multiple land use involving ranching and recreation, and with a wilderness land-use scenario. There are literally billions of combinations of modules possible in even a small sub-region. Therefore, a technique(s) is needed that will provide quick socio-economic impact "readings" at very low cost. The planner must be able to consider many combinations in plan formulation if he/she is to achieve anywhere near the optimum in terms of plan impact discussed earlier. Planning theorists talk about a "hill-climbing" methodology; a strategy, no matter how fine you tune it, may be capable of achieving only 60 per cent of optimal. In this case, the planner must shift and try a whole new strategy, then fine tune it. The planner may then achieve 80 per cent of optimal. Of course, you will never know how close you came to optimal unless you are God. The point is, a fast, inexpensive approach is needed to assess impact.

There are a few critical principles that apply to socio-economic work. One is that when doing "quick and dirty" socio-economic work, the analyst must identify correctly the direction of change. A technique is required, therefore, that will measure whether movement is toward your goals or away from them by taking this or that action. Dr. Anderson addresses this theme in his paper on methodologies to achieve goals. It is important to measure progress toward goals; that is, movement from the starting point even if you can not specifically measure how far you still must travel to fulfill the goals.

The second principle is related to the general order of magnitude in impact estimates. Although you will not be able to estimate impacts precisely, it is necessary to be able to formulate general order of magnitude estimates. Order of magnitude estimates may pertain to the number of jobs created, how much income will be generated, or the cost of an initiative to provincial and local governments.

I am basically advocating a nonparametric, goal-achievement approach. In utilizing such an approach, the analyst needs to do some homework before starting. First of all, it is necessary to know something about the futures of the sectors in question. There is much uncertainty in a resource economy where commodity price and demand futures are of concern. The futures information available, however, is probably better than a throw of the dice. For example, it can be said with fair assurance that a tourism resource of high quality will be worth more in the future relative to some type of a commodity resource such as forestry.

I referred earlier to "generic building blocks" or modules. Sometimes there are more commonalities than differences in impacts from a given generic type of resource initiative. The federal government is using this approach in the Northwest Territories for land use and regional development planning and impact assessment. Rather than doing separate impact and benefit-cost analyses for every resource project, such as an oil drilling initiative by Dome, the federal government has developed a generic module for oil drilling within a given range of magnitude under arctic conditions. This type of generic approach provides information about impacts, such as the amount of employment likely to be created or the probability of a blow-out and the probable damage if a blow-out occurs. The financial analysis done to date by Alberta Energy and Natural Resources has identified some of these generic ''building blocks''. A caution related to the question of synergism should be noted in using this approach. If ten similar projects are undertaken, the economic, financial and social impacts of each may be very different than the sum of those ten.

I am not arguing that analysts should not do the formal benefit-cost and socio-economic impact analysis discussed in these proceedings. When a plan has been developed and is generally acceptable, the analysts will probably want to use these formal methodologies so that the plans for one sub-region or project can be compared with another subregion, or with the activities of another department.

The iterative, module-based process I am advocating would not use too much time. In the long run, it would be much less expensive than the cash register process now being used. With the kind of approach I am advocating, the problem of having to go back to the drawing board is avoided. In the latter case, planning theorists would say you were ''on the wrong hill'' in terms of strategy formulation; you would virtually have to start ''de nouveau'' to do a new plan because economic, social, financial or employment feedback was not obtained in the formulation of the original plan.

The problem of internalizing is the real ''zinger'' in this type of work. It is very easy to use the cash register approach. If you produce a plan based on biophysical principles, it is relatively easy to do a benefit-cost, financial and socio-economic impact analysis after. The problem is internalization. An approach is needed that is ''quick and dirty'' and inexpensive, or a planning team can not analyse all relevant combinations.

Any approach must be meaningful to lay people. We may have been delinquent in the work we have done to date pertaining to financial, income, employment and demographic analysis of Alberta's integrated resource plans in that the output is somewhat technically complex. We should produce reports that are understandable by non-professionals.

Magnification of error occurs whenever we multiply or divide. The input data in benefit-cost, financial or socio-economic impact analysis have many errors. In many cases, very complex modelling leads to magnification of errors and a lack of comprehension of impacts by the noninitiated. Small-scale models can be very useful in simulating a certain type of impact. Very large-scale models are not relevant in Alberta cases. In reference to Dr. Hof's paper, I think his model is relevant in the United States, but the Alberta economy is less than 1/100 the size of the US economy. The technique appropriate in Alberta is different than that for a very large nation.

To reiterate, we must use considerable human judgment in our work, particularly when thinking about the future. Large models have very severe limitations. For example, one of the large utilities in this province has a lovely econometric model. The problem is that the model is based on the oil and gas industries operating and performing in the context of an OPEC-led market. Furthermore, it is not based on significant growth or improvements in amenities, information and tourism in our society. All of the above do not make the model useless. Instead, they mean there must be considerable human judgment applied to that model to change the co-efficients and make it more relevant to the very fast and structurally changing world in which we live. For example, we are facing de-urbanization in the western world for the first time, except for a brief period in the 1930s, in 500 years.

At some point, Alberta Energy and Natural Resources must decide how to handle socio-economic factors in integrated resource planning. This essentially entails adopting a consistent belief and methodological system as a context for planning operations. My major concerns are that the approach adopted should be appropriate for an economy and society the size of Alberta's and with Alberta's characteristics, and that the approach should be one which ensures that socio-economic factors are integral to the planning process. Realizing these two objectives will require a good deal of compromise with technical sophistication and academic niceties.

REFERENCES

Fairbairn, K.J. and R.G. Ironside. 1973. *An Economic Base Study of the Peace River Regional Planning Commission's Region*. A Report for the Peace River Regional Planning Commission. Grande Prairie.

Stewart, Weir & Co. 1984. *Jean D'Or Prairie Integrated Resource Plan: Financial, Income and Employment Analysis*. Prepared for Alberta Energy and Natural Resources. Edmonton.

QUESTION PERIOD

IAN DYSON:

I'm with the Resource Planning Branch. Doug, I'm interested in the generic applications you outlined. I think we can see the applicability of this kind of approach. I wasn't, however, aware of the synergistic problems – that's a bit of a "downer".

Do you think it's possible to complement this kind of generic technique with some overall economic assessment of major resource policies, either on a provincial scale or in a regional setting? Doing so would enable us to know in a broad sense, for example, whether irrigation expansion in southern Alberta or agricultural expansion onto marginal lands in the boreal forest add up. We would not only be evaluating projects using the generic methodologies (based on applications of the studies by Stewart, Weir & Co.), but could link with resource policy considerations as well.

DOUGLAS WEBSTER:

I think you can use the generic approach as a first cut, in terms of provincial policies. From what Mr. Stiles has described, it seems (in a "back-of-the-envelope" sense) that this is already occurring. In fact, the generic approach being used formally or informally by cabinet committees may be more sophisticated than I am aware. The Alberta caucus was basically using a generic approach during the boom times. For example, during that period, caucus often perceived that there was a labor bottle-neck, that capital was becoming short, or that the private sector was operating at capacity. As Mr. Stiles indicated, the government then had to act. Intuitively, caucus and cabinet often work on a generic basis.

MULTIPLE OBJECTIVE PLANNING: ITS POTENTIAL APPLICATION FOR INTEGRATED RESOURCE PLANNING IN ALBERTA

by: Dr. Marvin S. Anderson*

Introduction

What is multiple objective planning (MOP)? How has it been used? What are some of its practical strengths and weaknesses? Finally, to what extent might multiple objective planning be usefully employed in integrated resource planning (IRP) in Alberta?

Multiple Objective Planning

Multiple objective planning is essentially a process which involves the evaluation of plans or projects using more than one criterion. Specific criteria are derived from a set of broadly-defined objectives, called "component needs", for the jurisdiction in question. The generic term "multiple objective planning" can be used to describe virtually every planning and evaluation procedure which does not ultimately collapse all measurement criteria into a single yardstick (Figure 1).

The process itself is not novel. It acknowledges explicitly that all of the effects of an investment decision cannot always be quantified or monetized. It recognizes that other objectives must also be considered in conjunction with the traditional criterion of economic efficiency.

The national (or provincial) income account is still central to the MOP analysis. In addition, however, other objectives can include appropriate measurement criteria with respect to:

1. Environmental quality
2. Social well-being
3. Regional development, or more specific employment or target group considerations

All efficiency benefits and costs measurable in monetary terms are still handled in the national (provincial) income account. With MOP, this account provides no more than a measure of the income opportunities foregone by pursuing other social, regional or environmental objectives.

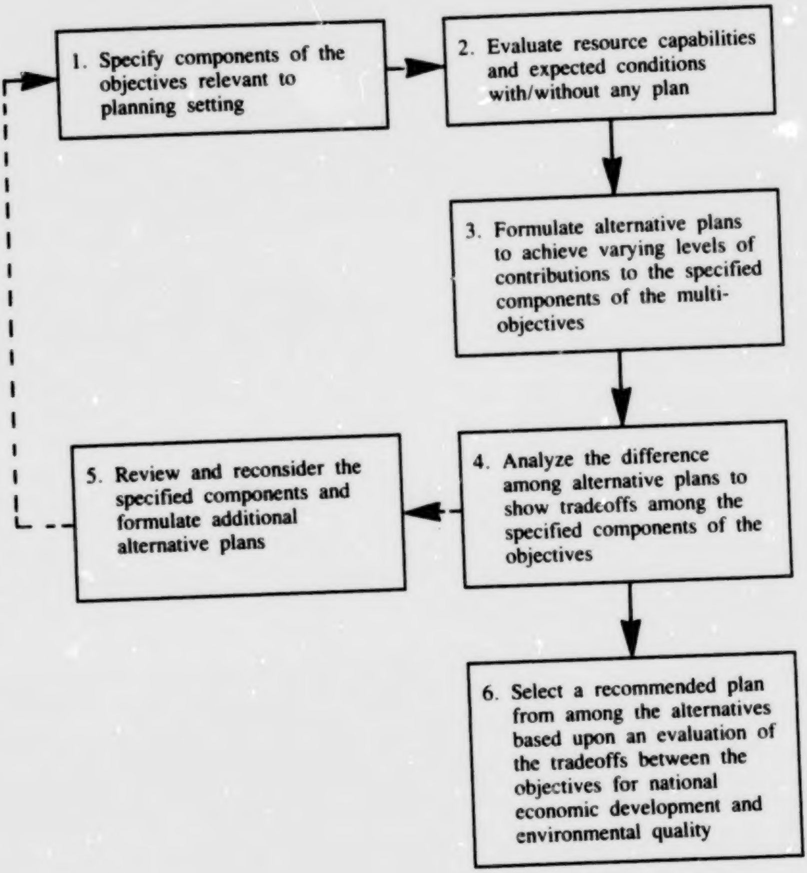
---

* Economic consultant, Marv Anderson & Associates, Sherwood Park, Alberta.

Although wholly responsible for the errors and omissions which remain, the author would like to thank Mr. Bob Morrison, Dr. Terry Veeman and Dr. Douglas Webster for comments on an earlier draft of this paper.

FIGURE 1

THE MULTIPLE OBJECTIVE PLANNING PROCESS


1. Specify components of the objectives relevant to planning setting
2. Evaluate resource capabilities and expected conditions with/without any plan
3. Formulate alternative plans to achieve varying levels of contributions to the specified components of the multi-objectives
4. Analyze the difference among alternative plans to show tradeoffs among the specified components of the objectives
5. Review and reconsider the specified components and formulate additional alternative plans
6. Select a recommended plan from among the alternatives based upon an evaluation of the tradeoffs between the objectives for national economic development and environmental quality

The value of the benefits of meeting objectives under the other accounts remains largely a matter of judgment. Whether they are worth more than the income opportunities foregone is not determined by the MOP process.

In this context, traditional benefit-cost analysis, however abused, is a sub-set of this more global planning framework.

Some of the more obvious practical and theoretical problems of MOP are discussed later, after first looking at a case study illustrating MOP.

An Example

The methodology developed for the South Saskatchewan River Basin Planning Program (SSRBPP) was chosen for illustration because this is a relatively large and recent study with which many social scientists in Alberta are familiar.

One of the keys to proceeding with a MOP process is the initial specification of all of the general objectives. This function was carried out by Alberta Environment (1982), summarized in figures 2(a) and 2(b).

These objectives represent a political "consensus" according to the professional judgment of the authors. Despite its probable political imperfections, it was a very commendable effort. Without this information, it would be very difficult for a technocrat/bureaucrat responsible for MOP to get even started.

FIGURE 2

THE SOUTH SASKATCHEWAN RIVER BASIN PLANNING PROGRAM - THE MULTIPLE OBJECTIVES

2 (a) General Economic & Social Objectives

1. To provide a diversified provincial economy which is less dependent on the sale of unprocessed resources, particularly non-renewable resources.
2. To encourage balanced economic growth throughout Alberta.
3. To build a strong private sector by strengthening small and locally controlled businesses within Alberta.
4. To develop a skilled workforce by upgrading the job skills of Albertans to achieve higher productivity, greater incomes and more job satisfaction.
5. To obtain a competitive advantage in the provision of certain goods and services by capitalizing on the province's natural advantages and building on strengths.
6. To improve the quality of life in Alberta.
7. To ensure that provincial resources are not wasted, damaged, or polluted.

2(b) Sectoral Objectives

Community Development Objective	To ensure that communities have opportunities to develop economically and improve their quality of life
Industrial Development Objective	To encourage development of processing and manufacturing industries that are efficient and internationally competitive
Agricultural Development Objectives	(a) To improve net farm incomes (b) To add to the viability of rural communities (c) To provide stability and security in the farm economy (d) To increase agricultural production in part through increases in the productive capability of agricultural land (e) To increase opportunities for family farm development (f) To promote the creation of secondary agricultural industries
Energy Development Objectives	(a) General Objective: To ensure the long term adequacy of energy supply for Alberta's needs. (b) Electric Energy Objectives: (i) To ensure that electric energy is provided at rates which are equitable and reasonable for both the customers of and the investors in electric utilities (ii) To ensure that the development and operation of hydro and other electric energy occurs in an economic, orderly and efficient manner
Tourism Objective	To develop tourism so that it contributes to balanced regional growth and diversification of the economy
Recreation Objective	To promote and encourage orderly development of recreational activities and facilities for the betterment of the people of Alberta
Fish Management Objectives	(a) To ensure that fisheries populations are protected from severe decline and that viable populations are maintained (b) To maintain the capability of surface water for fish production
Wildlife Management Objective	To ensure that wildlife populations are protected from severe decline and that viable populations are maintained
Environmental and Historical Resources Management Objectives	(a) To promote a desirable balance between economic development and environmental protection (b) To minimize irreversible environmental disturbances (c) To avoid unneccessary impact on historical resources, to preserve the most important historical resource sites whenever feasible and to promote the recovery of information from those sites which cannot be preserved

The SSRBPP actually involved a two-dimensional, multiple-objective planning framework: sectoral objectives and general economic and social objectives. The intention of the sectoral objectives was to facilitate understanding among policy-makers, many of which were represented by individual government ministries or departments, of the effects of alternative water allocations on water users.

While the SSRBPP evaluation framework made explicit the tradeoffs among sectors as well as among general objectives, it did so only by accepting the methodological cost involved. Clearly, the potential for overlap (i.e., double counting) among objectives and criteria was compounded, while it became more complex for decision-makers to apply relative weights within and among objectives in order to arrive at their decisions.

Once objectives were established, the next step was to develop working definitions and measurement criteria for each objective. More than one measurement criterion was used, frequently as a proxy for the specified objectives, as the following list illustrates with respect to agriculture (Figure 3).

FIGURE 3

OBJECTIVES, WORKING DEFINITIONS, AND MEASUREMENT CRITERIA FOR AGRICULTURE - SSRBPP

1.1 Change in real net farm incomes from farming operations (Farm Income)

1.2.1 Change in employment on farms and rural towns, villages and cities (pop. <40000) (Rural Viability)

1.2.2 Change in value-added on farms and rural towns, villages, and cities (pop. <40000) (Rural Viability)

1.3.1 Change in the annual variability of farm production levels (Stability and Security)

1.3.2 Change in the annual variability in real net farm incomes from farming operations (Stability and Security)

1.4 Change in the real gross revenue of crop production/hectare (Agricultural Production)

1.5 Change in the number of farms (Family Farms)

1.6.1 Change in the employment of agriculture-related manufacturing industries (Secondary Agricultural Industries)

1.6.2 Change in value-added in agriculture-related manufacturing industries (Secondary Agricultural Industries)

This procedure was then accompanied by an impact network for each sector which identified the intra-sectoral and inter-sectoral linkages between the respective criteria (Figure 4).

In other words, dozens of either quantitative or qualitative "indicators" were developed – an extensive inventory of inter-dependent and overlapping measurement criteria (Figures 5 (a) and 5 (b)).

The criteria were then used to evaluate various SSRBPP scenarios. As it turned out, it was not possible to use many of the criteria because the necessary data were not available or a direct connection could not be made between changes in water management and impact on water use. An extensive evaluation of water management options was made, however, and was reported by Alberta Environment (1984).

This was probably one of the most comprehensive water-related planning studies ever conducted in Canada. The dedication and commitment to this work was commendable.

Frankly, however, to an economic empiricist this process was extremely messy. At this point, whether the "bottom line" in the decision-making process will be improved in any way is still largely unknown. Some people fear that this effort may just turn out to be a more elaborate "lubricant of politically-sanctioned greed" (Bromley 1980).

Strengths And Weaknesses

The MOP process is just that, a process. Its limitations are readily apparent and include the following:

1. The existence of effects that are noncommensurate in no way abrogates the basic welfare criterion. The decision-maker must still seek to maximize the difference between the beneficial and the detrimental effects of a decision. In effect, he/she must still try to find that point where the net benefit transformation curve is tangent to the social indifference curve (Figure 6).

   Do we know the shape of the social indifference curve for numerous objectives? Equally important, how do we derive a net benefit transformation curve for a particular project to meet various objectives? Unless relative weights can be specified for specific criteria within each objective and among all objectives, the socially optimum decision will still have to be determined by the political process.

2. For those effects that can be measured and valued with MOP, the decision-maker must still rely on the concept of "willingness-to-pay" in determining the value of the effect to people. This proposition, which is also generally employed in traditional benefit-cost analysis, is based on an individualistic approach which states that

Figure 4
AGRICULTURE NETWORK

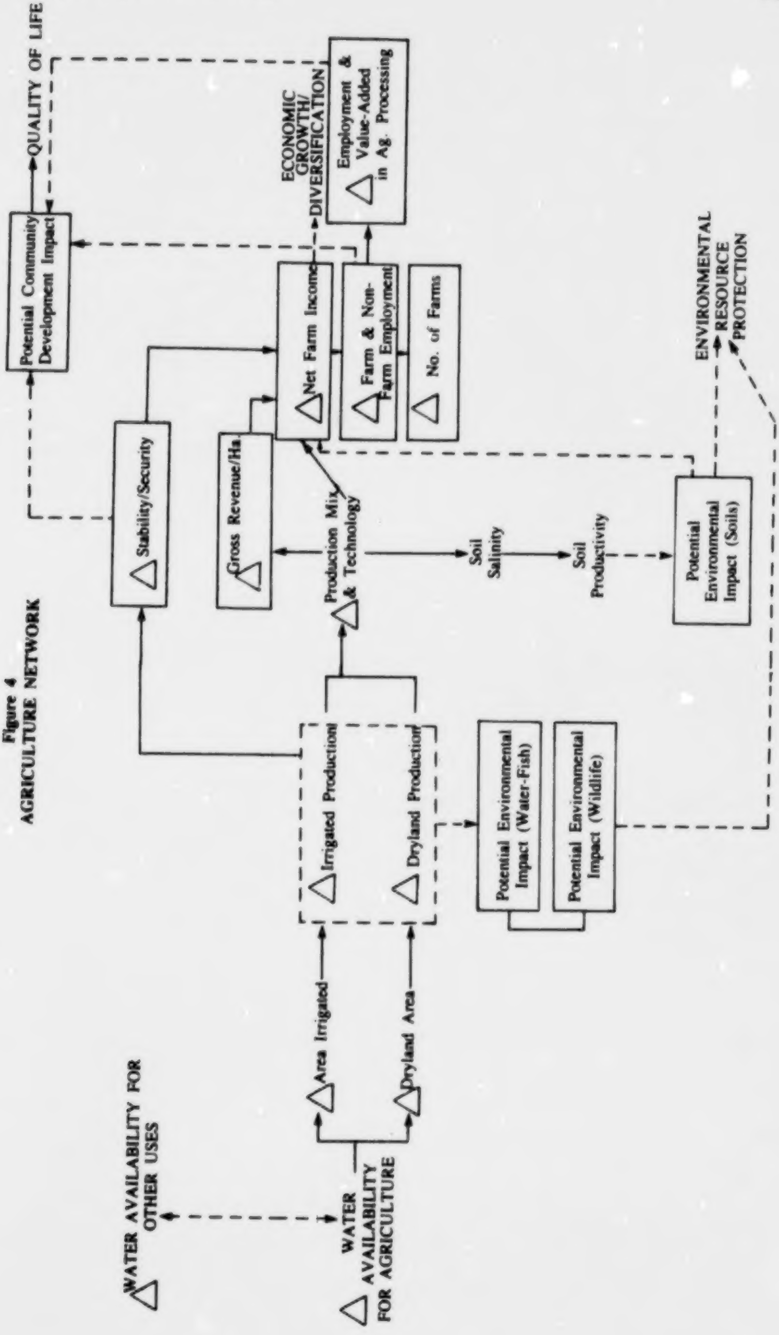

△ WATER AVAILABILITY FOR OTHER USES
△ WATER AVAILABILITY FOR AGRICULTURE
△ Area Irrigated
△ Dryland Area
△ Irrigated Production
△ Dryland Production
Potential Environmental Impact (Water-Fish)
Potential Environmental Impact (Wildlife)
△ Stability/Security
△ Production Mix & Technology
△ Gross Revenue/Ha.
Soil Salinity
Soil Productivity
Potential Environmental Impact (Soils)
△ Net Farm Income
△ Farm & Non-Farm Employment
△ No. of Farms
Potential Community Development Impact
QUALITY OF LIFE
ECONOMIC GROWTH/ DIVERSIFICATION
△ Employment & Value-Added in Ag. Processing
ENVIRONMENTAL RESOURCE PROTECTION

Figure 5(a)

GENERAL SOCIAL AND ECONOMIC EVALUATION SUMMARY

	Bow Sub-Basin	Oldman Sub-Basin	Red Deer Sub-Basin	South Saskatchewan Sub-Basin	Total SSRB	Province of Alberta
PROVINCIAL INCOME GROWTH AND DIVERSIFICATION						
Change in real net farm income						
Change in industrial water treatment costs						
Change in municipal water treatment costs						
Change in electricity generation costs						
Change in historical resource preservation costs						
Change in land and building displacement costs						
BALANCED REGIONAL GROWTH AND DEVELOPMENT						
Change in income/capita						
Change in sectoral employment						
Change in population growth						
QUALITY OF LIFE						
Change in demographic balance						
Change in rural employment						
Change in farm income variability						
Change in assessment/capita						
Change in services and amenities						
Displacement of people and property						
Change in level of recreation opportunities						
ENVIRONMENTAL RESOURCE PROTECTION						
Major changes in fisheries habitat/population						
Major changes in wildlife habitat/population						
Major changes in future land productivity for agriculture						
Major changes in future resource suitability for recreation						
Number of major-value historical sites threatened						

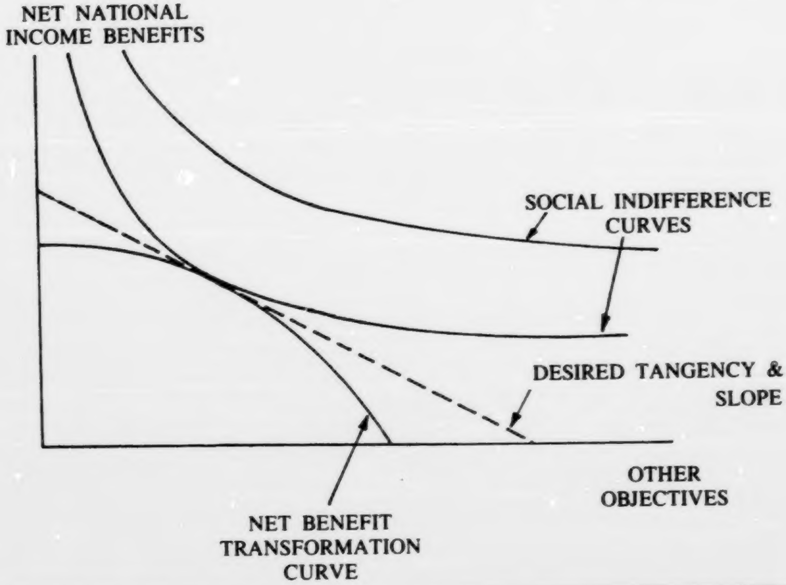
Figure 5(b)

SECTORAL EVALUATION SUMMARY

	Bow Sub-Basin	Oldman Sub-Basin	Red Deer Sub-Basin	South Saskatchewan Sub-Basin	Total SSRB
AGRICULTURAL DEVELOPMENT					
Change in real net farm income					
Change in rural employment					
Change in rural value added					
Change in farm income variability					
Change in farm production variability					
Change in real crop revenue/hectare					
Change in number of farms					
Change in agricultural industry employment					
Change in agricultural industry real value added					
INDUSTRIAL DEVELOPMENT					
Change in industrial treatment costs					
ENERGY DEVELOPMENT					
Change in % generation from renewable resources					
Change in cost of electrical energy					
FISHERIES MANAGEMENT					
Change in fisheries habitat/populations					
WILDLIFE MANAGEMENT					
Change in wildlife habitat/populations					
RECREATION DEVELOPMENT					
Change in physical extent of recreation resources					
Change in number of recreation sites					
Change in level of recreation opportunities					
TOURISM DEVELOPMENT					
Change in number of tourist facilities/opportunities					
ENVIRONMENTAL AND HISTORICAL RESOURCE MANAGEMENT					
Major change in fisheries habitat/populations					
Major change in wildlife habitat/populations					
Major changes in future land productivity for agriculture					
Major changes in future resource suitability for recreations					
Number of moderate historical resource sites and costs for preservation					
Number of major historical resource sites for conservation					
COMMUNITY DEVELOPMENT					
Change in number of jobs by sector					
Change in income/capita					
Change in assessment/capita					
Change in total population					
Change in population growth rate					
Change in demographic balance					
Change in municipal treatment costs					
Change in services and amenities					
Change in community identification					
Displacement of land, homes and people					
Change in community conflict potential					

FIGURE 6

THE OPTIMUM DECISION-MAKING RULE


NET NATIONAL INCOME BENEFITS
SOCIAL INDIFFERENCE CURVES
DESIRED TANGENCY & SLOPE
OTHER OBJECTIVES
NET BENEFIT TRANSFORMATION CURVE

the prices observed in a smoothly functioning economy reflect the incremental value to people of the beneficial and detrimental effects of a decision (Margolis 1969).

3. In addition, when deciding categories for the non-valued effects, the decision-maker must take care to ensure that his/her nonvalued-effect categories do not overlap with each other or do not include beneficial and detrimental effects that are or could be included in the category of commensurate and valued effects. Furthermore, if individual preferences are to count, it must be demonstrable that there is some positive connection between what is defined to be a nonmoney-valued benefit and human welfare, and, conversely, a negative connection between a nonmoney-valued cost and human welfare. This is indeed messy.
4. Finally, for those effects that are measurable but for which no money value is obtainable either by direct observation or by inference from market-related behavior, the decision-maker must prepare a tableau for each project listing the benefits (both money-valued and other) and costs (both money-valued and other). Unless weights (values) can be specified or there is a political process for

choosing among projects, the social optimum cannot be defined and nothing further can be said about the choice of projects.

To reject MOP totally because of these limitations, however, may be premature. Maybe we would be ''throwing the baby out with the bathwater''. There are some very real advantages to the MOP process.

Most importantly, perhaps, it broadens the perspective of both the researcher and the decision-maker. Very often, just using a unitary, benefit-cost ratio, however generated, to evaluate/rank/optimize a proposed project is NOT appropriate. The addition of other economic criteria, such as the net present value, may still be only marginally better. It is often highly desirable that other criteria are considered.

MOP also introduces more rigor into a comprehensive, multidisciplinary impact analysis, particularly regarding the ''softer sciences.'' The MOP process essentially dictates that quality-of-life, environmental degradation, regional balance, etc., somehow be defined. The process is imperfect but still very useful.

At the very least, therefore, MOP greatly helps to develop a common language for all participants in the decision-making process. Just producing a comprehensive list of the various decision-making criteria is a useful beginning.

Final Comment

Multiple Objective Planning, in a generic sense, is the ''only game in town''. Benefit-cost analysis is a subset of this family of evaluation criteria. The critical question, then, is really how the general planning and evaluation process can be made more effective. In this regard, I would like to conclude with five comments which are probably biased by my perspective as an economic consultant:

1. I would strongly urge that analysts begin by standardizing the traditional, benefit-cost methodology because benefit-cost analysis is an integral part of MOP. Initially, therefore, analysts should concentrate on this aspect, at least with respect to some of the more obvious and frequent benefit-cost deficiencies: accounting stance, discount rate, multipliers, time frame, etc.
2. Analysts should build relative income and income distribution considerations directly into the benefit-cost methodology. The World Bank does this so why don't Alberta analysts do it?
3. Concurrently, analysts should concentrate on standardizing the measurement of environmental impacts, limiting this to major impacts, and even using something simplistic like a replacement-cost approach for measurement purposes.

4. Analysts should then try to integrate points (1), (2) and (3) into an increasingly comprehensive but very explicit and standardized "bottom line". In this regard, a complementary sensitivity analysis is also highly recommended with respect to alternative weighting systems for various investment options.
5. Finally, analysts should keep the process relatively simple; don't confuse complicated with sophisticated. If we are professionally ambiguous, we are, *ex ante*, politically impotent.

In short, what I am saying is that the role of economics in integrated resource management is currently (and not incorrectly) being defined by our own professional shortcomings. Politically, this translates into a credibility problem.

Analysts can not circumvent the problems associated with conventional benefit-cost analysis by adopting multiple objective planning. This would only widen the prevailing credibility gap. Our first priority, therefore, should be to develop a consistent benefit-cost method all Alberta social scientists could understand. We would then be in a much better position to re-assess the merits of multiple objective planning.

REFERENCES

Alberta. Environment 1982. *Inventory of Current Objectives for Water Management*. Edmonton: Alberta Environment, Planning Division, South Saskatchewan River Basin Planning Program.

Alberta. Environment 1984. *South Saskatchewan River Basin Planning Program, Summary Report*. Edmonton: Alberta Environment, Planning Division.

Bromley, D.W. 1980. "The Benefit-Cost Dilemma". In *Western Water Resources*. Papers from a Symposium Sponsored by the Federal Reserve Bank of Kansas City, pp. 227-248. Boulder: Westview Press.

Margolis, J. 1969. "Shadow Prices for Incorrect or Non-Existent Market Values". In *The Analysis and Evaluation of Public Expenditures: The PPB System*. A Compendium of Papers Submitted to the Subcommittee of Economy in Government, pp. 533-546. Washington: US Congress Joint Economic Committee.

FURTHER SELECTED REFERENCES

Environment Canada. 1985. Various papers from the Inquiry on Federal Water Policy. Ottawa: Environment Canada.

Freeman, A.M. and R.H. Haveman. 1970. "Benefit-Cost Analysis and Multiple Objectives: Current Issues in Water Resources Planning". *Water Resources Research* 6: 1533-1539.

Maass, A. et al. 1962. *Design of Water Resource Systems*. Cambridge: Harvard University Press.

Major, D.C. 1969. "Benefit-Cost Ratios for Projects in Multiple Objective Investment Programs". *Water Resources Research* 5: 1174-1178.

Marglin, S.A. 1967. *Public Investment Criteria: Benefit-Cost Analysis for Planned Economic Growth*. Studies in the Economic Development of India, vol. 4. Cambridge: M.I.T. Press.

Strong Hall and Associates, Marv Anderson & Associates Ltd. and Environmental Management Associates. 1983. *South Saskatchewan Basin Planning Program: Evaluation Methodologies and Data Base*. Edmonton: Alberta Environment, Planning Division.

Veeman, T.S. 1985. "Benefit-Cost Analysis in Environmental Decision-Making: Procedures, Perils, and Promise". In *Economy & Ecology: The Economics of Environmental Protection*. A Symposium Sponsored by the Canadian Society of Environmental Biologists (Alberta), pp. 129-138. Edmonton: Canadian Society of Environmental Biologists.

Water Resources Council. 1979. *Procedures for Evaluation of National Economic Development (NED) Benefits and Costs in Water Resources Planning (Level C); Final Rule, Part IX*. Federal Register, Vol. 44, No. 242 (Friday, December 14, 1979), Rules and Regulations. Washington: US Government.

QUESTION PERIOD

(Dr. Anderson invites Bob Morrison of Alberta Environment to speak.)

BOB MORRISON:

Do you have that sectoral objectives chart? I can give you an idea of what we accomplished by the end of the study.

MARV ANDERSON:

The ones you really paid attention to?

BOB MORRISON:

Well, the ones we were able to pay attention to. Let's start with the first objective: community development. This is what Doug Webster was talking about, the social impact. As Marv knows from the development of the methodologies, we had a terrible time trying to come up with specific techniques that could give us answers that would relate to specific proposals or, in our case, strategic options. We spun our wheels on that and finally ended with two reports, one on state-of-the-art social impact assessment, at least in terms of water management, and another report that took a very cursory look at the impact of irrigation on community services, health services, and that sort of thing. This was not very definitive, but at least it gave us a start in trying to assess that kind of thing.

On the industrial development objective – trying to assess the impact of changes in water quantity and quality on industry – we had some trouble but were saved by saying that industries use such a small amount of water that we'll just assume that it's satisfied. As a result, we didn't have to look at the possibility of short-changing industry.

On the agricultural side, Marv was involved primarily in developing the techniques and I think, despite the criticisms that have been made of the methodologies, and Dr. Veeman has made some in the past, we have a fairly solid methodology. The questions that you have to answer in that area – at least that we had to answer – are, for example, "do you look at secondary benefits? And if you do, how do you use them in your analysis?" It was a question of what do you do with the methodologies you have.

In terms of the energy objective, we did some analysis of the impact of using hydro storage for irrigation and came up with some cost figures.

As for tourism/recreation, we developed what we like to call the "state-of-the-art". Unfortunately, it was mush to a large extent. The people who worked on that committee worked very hard, though, and we came up with some very interesting things in terms of criteria for judging the impact of changes in water quantity and water quality on boating and other types of water-based recreation. We even made a valiant attempt to come up with an assessment of the impact on esthetics. The biggest hole in all that was simply a lack of economic data, something that we hope to rectify in the future.

In terms of fish management we ran into the same kinds of problems as we did with the recreation work. We did come up with the first attempts, at least in Alberta, to identify the impact of changes in water quantity and water quality on fish.

On the wildlife side we didn't come up with anything useful. We were, however, able to identify some impacts of breaking new land for irrigation and the impacts of that action on wildlife. Unfortunately, the data base didn't allow us to develop any way of evaluating impacts. This concerned primarily land in the White Zone, although there might be some public land involved if you went ahead and actually implemented a project.

In terms of environmental and historical resources objectives, we came up with very little. We were roundly criticized, and justifiably so, because we simply didn't have the data base to evaluate such things as the impact of regulated flows on riparian vegetation.

Now, the strengths and weaknesses that Marv has pointed out are, I think, right on the mark. The fact that the process is cumbersome is something that you simply have to overcome. We ran into a lot of people who would tell us that the information we came up with was simply not understandable to them. A lot of those people hadn't actually read anything, but they said that to us anyway. The solution, however, is not to use weightings and that sort of thing, at least not weightings developed by public servants. Our philosophy in the South Saskatchewan program was that we, as public servants, are there to provide the technical information to allow elected representatives to choose among different options. The solution to complexity is not for us to provide the weightings and recommendations. The job of decision-makers, the politicians in consultation with the public, is to put weights on the impacts. This takes decisions from behind closed doors where we bureaucrats are known to work and puts decision-making into the hands of the people who are elected to make those decisions.

MARV ANDERSON:

Thanks, Bob. If I might interject, Bob mentioned one very important point which I missed, and that is that multiple objective planning seems to have considerable utility as a public participation tool, because if you can list everything very explicitly, that's precisely where you get some indication of the weights. I didn't mention that, but it's something that should be emphasized.

Dr. Veeman, you're being awfully quiet. Any comments? Dr. Phillips, perhaps?

TERRY VEEMAN:

(Inaudible from the floor.)

MARV ANDERSON:

Yes, I'm unsure. How do people within government, when they're given the terms of reference, and it applies to consultants or university contracts too, keep the alternatives wide? For instance, no development. I've not looked at that alternative in 12 years of consulting. So, Bob, and you can correct me if I'm wrong, weren't the terms of reference you were given narrowed to supply augmentation?

BOB MORRISON:

No, they weren't. The problem that we had was in terms of demand management. The reason why we were charging up the wrong hills, as Dr. Veeman put it, is because we didn't have another hill to charge up. People talk of demand management as if it's a fairly simple thing to do. Everybody's an expert on the efficiency or inefficiency of irrigation. Unfortunately, that's one of the areas where we had the fewest reliable data. We simply were unable to correct that problem in the South Saskatchewan program. Maybe someone can come back and say we should have started sooner, but we simply did not have the time to come up with the necessary information. It certainly is a viable option, one that we'd like to pursue in our future planning.

WALTER URQUHART:

I'm from the Tourism Industry Association. I appreciate Bob's remarks about the "mush" as far as tourism is concerned. I would like to toss to the planning people the suggestion that tourism is ready and able to serve your requirements in a consultive way. There are many available experts in the province, both in the government and in the private sector. I suggest that when you examine this area of tourism, consultation with these people would make your reports more viable. Incidently, tourism has money now!

THE VALUATION OF INTANGIBLE BENEFITS AND NON-MARKET COMMODITIES: TECHNIQUES AND APPROACHES APPLICABLE TO RESOURCE PLANNING AND MANAGEMENT

by: Dr. Elizabeth A. Wilman*

Introduction

There are two parts to the problem of valuing something. The first is to decide on the appropriate meaning of the concept ''value''. The second, which is conditional to the first, is deciding how to measure the value.

In deciding on the appropriate meaning of the concept ''value'', it is useful first to consider the problem at hand. In this case it is to carry out integrated resource planning in such a way as to ''optimize use of the provincial resource base to achieve maximum benefits for Albertans, now and in the future'' (Alberta ENR 1983). While one would expect that ENR would have multiple objectives incorporated in its objective function, one of these objectives should be economic efficiency. According to the economic efficiency objective a potential change in the allocation of resources should only be effected if it would result in a net increase in total income to Albertans. If one was also concerned about whose income was increased and whose income was decreased, this would be evaluated with respect to the income redistribution goal. Both in evaluating the extent to which alternative patterns of resource use contribute to provincial income, and in assessing the efficiency costs of other goals, such as the income redistribution goal, the planner needs to have good measures of the economic efficiency benefits and costs. Hence, the concept of ''value'' is addressed here in a context of economic efficiency.

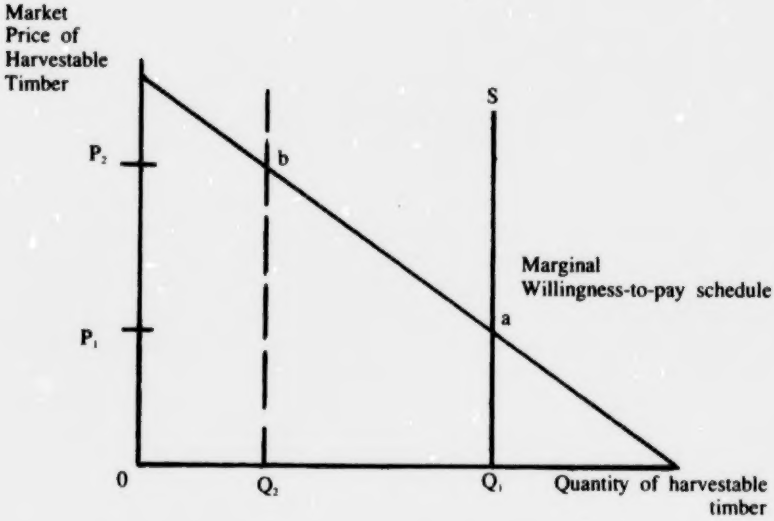
The economic efficiency concept of value reflects one of the fundamental principles of economics; in a world of finite resources, the value of an object can be measured by the income people would be willing to give up to obtain it. This ''willingness-to-pay'' concept reflects two things. First, it reflects the extent to which the potential payers want the goods or service. Second, it reflects the extent to which they have something to give up in order to obtain it. In a competitive market, prices will reflect the marginal willingness-to-pay for the last unit exchanged. If some change in the use of public land, such as more timber harvesting, causes a small increase in the amount of a commodity (harvestable timber) for which there is market price information, then this price information can be used to value, or estimate the benefits from, the change. If the change is large, then it may cause the market price to change. This result necessitates that we know not only the current price, or the marginal willingness-to-pay for the last unit, but the whole willingness-to-pay schedule over the range of change in the quantity of harvestable timber. In Figure 1, if the quantity of harvestable timber changes from OQ_1 to OQ_2, the marginal willingness-to-pay will increase as the quantity of harvestable timber decreases. Each unit lost should be valued at the marginal willingness-to-pay amount associated with the quantity of harvestable timber still available. In Figure 1, a loss of $OQ_1 - OQ_2$ is valued at Q_2baQ_1.

---

* Department of Economics, The University of Calgary, Calgary, Alberta.

Figure 1

Measuring the Value of an Increase in Harvestable Timber



The problem addressed in this paper is that some of the products and services provided on public land – for historical, legal or technical reasons – have no market prices, or have prices that are unrelated to the marginal willingness-to-pay. I will not discuss the estimation of values for raw materials like wood, forage and minerals because the final products from these resources are typically priced in organized markets. This does not mean there are no problems in estimating benefits from timber, forage and minerals, but the problems are less severe than for services for which there is no price at all. Water sometimes falls into the same category as raw materials, in that the final products may be market-priced industrial and agricultural products.

This brings us to the category of products and services with which this paper is concerned, the non-market or intangible category. The terms "non-market" and "intangible" are used to cover a wide variety of situations in which markets don't exist or are institutionally constrained, and in which there are no market prices for either an immediate or final product. This is not to say there is no market information that can be brought to bear on the question, but only that any information provided is indirect and its interpretation not as straightforward as when there is direct market price information.

The services with which I am concerned are of two types: 1) user services and 2) non-user services. User services are those for which the act of consumption or use leaves some trace in the market. For example, the recreational user might have to travel to the recreation site. Non-user services are those for which there is no observable act of consumption or use. For example, some people might be willing to pay for the continued existence of a wildland area, even if they never visit it. In this case there is no trace at all left in the market. Sections II and III of this paper will address the problems of measuring the values of user services and nonuser services respectively. Section IV discusses the concept of quasi-option value. This is not the value of a specific, non-market commodity or service, but a value that can be created by a flexible decision process enhanced by improvements in information.

Non-Market User Services

The most common type of non-market user service provided by public land is recreational opportunities. There are two basic categories of methods currently used to estimate the value of recreational opportunities. The first uses indirect market information to infer the value of the non-market service. The second constructs hypothetical markets through survey research techniques in which respondents reveal their willingness-to-pay.

The Use of Indirect Market Information

The Single-Site Travel Cost Model

The primary approach in this category has been the travel cost approach. It has relied on observations of choices made by individuals to reveal their demands. Hotelling[1] suggested first that travel costs might be viewed as necessary expenditures to consume the services of a recreation site. Assuming there was a group of consumers with the same demand curve, variation in their required travel expenditures would allow identification of their common demand curve and an estimation of the consumer's surplus benefits based on proximity to the site, each of them would enjoy.

---

[1] See the letter from H. Hotelling in R.A. Prewitt, 1949. "The Economics of Public Recreation: An Economic Study of the National Parks." Washington: The National Parks Service.

The basic travel cost approach is detailed by Clawson (1959) and Clawson and Knetsch (1966). The consumer of recreation visits has a marginal willingness-to-pay function for trips to a recreation site that may be expressed as

$$P = g(n), \text{ or } n = f(P) \tag{1}$$

where P is the marginal willingness-to-pay for a trip and n is the number of trips. In general, one would expect P to decrease as n increases, so that the marginal willingness-to-pay functions (or demand curves) would be negatively sloped like the one in Figure 1. Because there is a travel cost (c) that the consumer must pay to visit the site, in deciding whether or not to make a given trip the consumer has to assess whether his marginal willingness-to-pay is at least as great as the cost of the trip. Only if this is the case will he make the trip. The travel cost is important in two ways. First, the marginal willingness-to-pay for the recreational opportunity provided by a visit to a recreation site, must have the travel cost discounted. The area under the marginal willingness-to-pay function and above the travel cost curve is the value of the recreational opportunity the consumer consumes. This amount is commonly called the consumer's surplus. In Figure 2, def is the consumer's surplus value to a typical consumer.

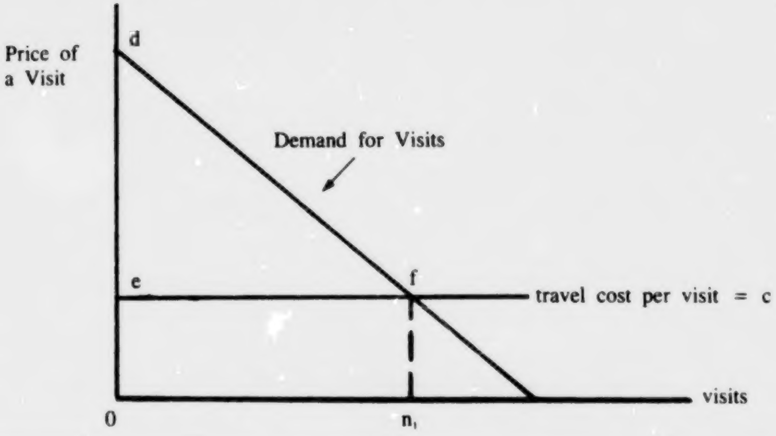
The second important thing about the travel cost is that it provides an estimate of one point on the consumer's demand curve. In Figure 2, point f is observed. The marginal willingness-to-pay at that visit level (on_1) is n_1f. Over a cross section of consumers with the same demand function but facing different travel costs to get to the site, sufficient points on the demand function may be observed to identify it. The area under that demand curve and above the consumer's travel cost gives the consumer's surplus or the benefit the consumer derives from visiting the site. Aggregating all consumers gives the aggregate site demand curve and the consumer's surplus estimate of benefits derived from the site.

The Multiple-Site, Travel Cost Model

The travel cost approach, as discussed so far, is most useful for estimating the total value of a recreation site. Changing patterns of resource use, however, usually do not create or destroy recreational opportunities, but rather change the quality of those opportunities. One can view what is provided at a recreation site as being a bundle of characteristics, including vegetation characteristics, wildlife characteristics and water-

Figure 2

A Consumer's Demand for Recreation Visits



related characteristics.[2] If the satisfaction recreationists derive from visiting the site depends at least in part upon these characteristics, then they will also affect the willingness-to-pay. To the extent that management practices alter these characteristics, they will in general alter the willingness-to-pay for the recreation opportunity.

This suggests that the basic travel cost model needs to be amended to take into account the quality characteristics of sites. Assuming site quality can be described in terms of one characteristic q, the consumer's demand for visits to a recreation site can be written as:

$$P = g(n,q) \text{ or } n = f(P,q) \tag{2}$$

where q is the level of the site quality characteristic.

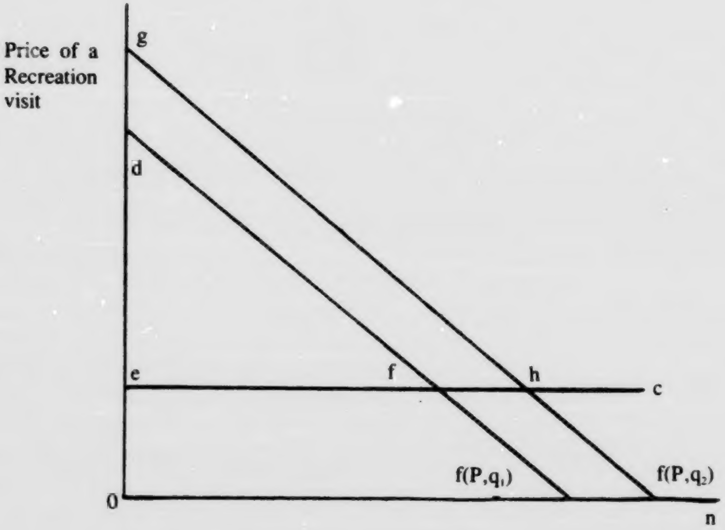
The variable q acts as a demand curve shifter, so when site quality is increased from q_1 to q_2 the demand curve for visits to the site shifts to the right. This is shown in Figure 3, where the demand curve with q_1 is $f(P,q_1)$ and with q_2 it is $f(P,q_2)$. The consumer's surplus benefit at q_1 is edf, and at q_2 it is egh. The increase in quality has increased the value of the site by the amount of gdfh. This can also be called the value of the quality change.

---

[2] Support for the hypothesis that recreationists do receive satisfaction from the vegetation and wildlife characteristics of the sites they visit is provided by the study by Haas et al (1979). In a study of the satisfaction of wilderness users in three Colorado study areas, Haas found that vegetation characteristics (meadows, forests, etc.), water-related characteristics and wildlife characteristics all were rated by recreationists as contributing to the satisfaction they derived from the wilderness experience.

Figure 3

Site Quality as a Demand Curve Shifter



When we are trying to estimate the value of a quality change, however, seldom can we effect a change in site quality and measure the shift in the demand curve. Rather, cross-sectional data with multiple sites usually are used to obtain the variation in q necessary to estimate the effect of a change in q at a given site. In the simplest case, it is assumed that the sites are not substitutes for one another. The difference between the consumer's surpluses generated by sites with different levels of q measures the value of a quality change at one of the sites. The current state of the art in the no-substitutes, multiple-site models is the varying parameter model used by Desvousges, Smith and McGivney (1982), and by Vaughan and Russell (1982). It can be written as:

$$n_{ij} = f(q_i, c_{ij}) \qquad (3)$$

where: n_{ij} = visits to site i by a consumer at location j;

q_i = quality of level of site i;

c_{ij} = cost of visiting site i from location j.

If the no-substitutes model is considered not appropriate, the prices and qualities of substitute sites need to be included as predictors. Then we get:

$$n_{ij} = f(q_i, h_{ij}, q_k, h_{kj}, q_l, h_{lj}, \ldots, q_z, h_{zj} \tag{4}$$

where k through z are substitute sites for i.

Now, an increase in q must be simulated by a comparison between sites with different q_i, but with the same prices and quantities for the substitute sites k through z. There is a question of how to specify the substitute sites. Site k, for example, could be a specific site, or it could be merely a site of a specific level of quality. If the former specification is used, then it may be easier to replace the substitute price and quality terms with an index of overall substitute availability and quality. This is what is done in the multiple-site, travel cost models, such as those of Cesario and Knetsch (1976).

The second alternative is to group together sites of a given quality level, and identify them as site type k. The substitute cost variable for site type k, for an individual from location j, is the minimum cost required to visit a site of type k. Burt and Brewer (1971), and Cicchetti, Fisher and Smith (1976) used this type of model. Suppose there are m site types. Then for an individual at location j, a system of m demand equations exists.

$$\begin{aligned} n_{ij} &= f_1(c_{1j}, c_{2j}, c_{3j}, \ldots, c_{mj}) \\ n_{2j} &= f_2(c_{1j}, c_{2j}, c_{3j}, \ldots, c_{mj}) \\ &\bullet \\ &\bullet \\ &\bullet \\ n_{mj} &= f_m(c_{1j}, c_{2j}, c_{3j}, \ldots, c_{mj}) \end{aligned} \tag{5}$$

Now an increase from q_1 to q_2 at a given site changes its site type. In general, this means that the cost to get to a site of quality q_1 will be increased, and the cost to get to a site of quality q_2 will be decreased. If one measures the total consumer's surplus for all sites together before the change in q, and the total consumer's surplus after the change in q, the difference is the value of the q change for the individual at location j. Aggregating overall consumers gives the total value of the q change.

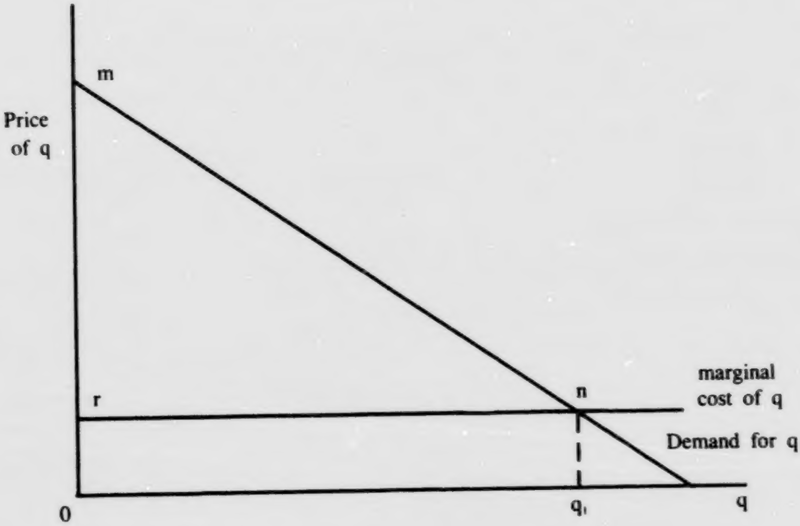
The Hedonic Approach

All the travel cost models view the number of visits as the main-choice variable involved in a consumer's recreation decision. In the multiple-site models, which allow for the sites to be substitutes, the consumer can also choose the site he wishes to visit. The number of choices available, however, will be limited.

Hedonic models take the opposite view that site quality is the main-choice variable. The consumer may also have some possibilities for choice of the quantity to be consumed, but these are more limited. The origin of the hedonic models is in the literature on demand for consumer durables where it is in fact true that the range of choices available is greater in the quality dimension than in the quantity dimension.[3]

There are some cases in the outdoor recreation area where the view taken by the hedonic model may be more appropriate than that taken by the travel cost model. For example, if the hunting season is very restricted in length, the consumer may be effectively constrained in the quantity he consumes, and the main choice available to him may be quality of the site he visits. Suppose, for example, that the consumer is constrained to a one-weekend hunting trip, but that he has a wide variety of sites of different qualities available to him. It will make more sense to look at his demand function for q, rather than his demand function for n. In general, one would expect the former to slope downwards, and it may look something like the demand curve shown in Figure 4. Travel costs are also

Figure 4
The Demand for Quality



---

[3] For a discussion of the hedonic approach as it applies to markets, such as housing, see Rosen (1974).

important in applying the hedonic model to the outdoor recreation case. Each of the sites available for the hunter to visit has a travel cost associated with it. In general, one would expect the hunter to make his decision about whether to go to a higher-quality site rather than a lower-quality one by comparing his marginal willingness-to-pay for the extra quality with the marginal cost of obtaining it. The marginal cost of obtaining it is measured by comparing the travel cost to the higher-quality site with the travel cost to the lower-quality site. If the travel cost to the former is higher than the travel cost to the latter, then the marginal cost is positive. Otherwise the marginal cost is zero. By comparing his marginal willingness-to-pay for successively higher-quality levels with the marginal cost of obtaining those levels, the hunter can choose the site which yields the greatest consumer's surplus. In Figure 4, this point would be the site with quality level q_1. The q_1 level of the marginal willingness-to-pay for q is nq_1, and the marginal cost of obtaining another unit of q is also nq_1. Over a cross-section of consumers with the same marginal willingness-to-pay function, but facing different marginal cost functions for obtaining increasing levels of q, the marginal willingness-to-pay function can be identified. The hedonic approach is relatively new and has been used in only a few applications. (Brown and Mendelsohn 1984; Mendelsohn 1984a; Mendelsohn 1984b and Wilman and Sherman 1983).

Stochastic Elements

The models discussed so far have been concerned only with deterministic choices. This need not be the case, however. It is probably unrealistic to assume that a recreationist has perfect information upon which to base his decisions about whether or not to make a visit and which site to visit.

The stochastic element in the decision of whether or not to visit a particular site has long been part of applications of the travel cost approach in which "per capita visits" is a measure of the expected visit level of an individual at a given origin. Ideally, one would like to have as data not just the expected visit level but separate measurements of whether or not an individual made any visits and, if so, the number of visits. Then the "Tobit" procedure (Tobin 1958), which is a hybrid of multiple regression and "probit" analysis, could be used. This procedure is preferable to ordinary least squares (OLS) regression of visits on travel cost and other predictors because the dependent variable (visits) cannot take negative values and the assumptions of OLS are not realized. The OLS regression coefficients would, in general, be biased because the non-observed (negative) visit levels of non-visitors are not the same as the observed visit levels of visitors. The Tobit procedure corrects for this bias and estimates an expected visit demand curve.

The same sort of bias can also exist in the hedonic model. If the visit level is fixed, and thus the same for observed visitors and non-observed non-visitors, there is no problem with bias in this dimension. If, however, the site choices that non-visitors would have made are different than those a visitor – facing the same set of site qualities and relative prices – would have made, the coefficients of the demand curves for the quality characteristics may be biased. Heckman (1976) has suggested a method for dealing with this type of bias. Bias can be ignored, however, if the site choices of visitors and non-visitors are the same, hence do not change as the probability of participation changes.

This leads us to consideration of site choice itself as a probabilistic event. If this were the case, a recreationist facing a given set of prices and site qualities would have a probability distribution for site choice, rather than a certainty of choosing a given site. Changing the set of prices associated with the site qualities would in general change the probability distribution. Morey (1985) and Bockstael, Hanemann and Kling (1985) have applied multinomial logit models to the site-choice decision. Morey assumes a constant visit level (one visit). His sample includes only those individuals who make a visit. The probability of visiting a given site is a function of the utility provided by that site relative to all other sites and the cost of visiting that site relative to visiting all other sites. The utility is derived from site characteristics. As a consequence, the probability of visiting a site is a function of the levels of a set of characteristics available at that site relative to the levels of the characteristics available at all other sites and the cost of visiting that site relative to those at all other sites. This model is similar to the gravity model approach mentioned earlier (Cesario and Knetsch 1976), in that the prices and characteristics of all sites are included as predictors. If one accepts, however, the framework of Burt and Brewer (1971), only the least expensive sites of a given type need be included.

Some Problems in Application

Some problems arise in all of the applications. One of these involves time costs. There are time as well as monetary costs involved in visits to a site. If consumers have the same opportunity costs of time, and the length of time on-site does not vary, then only travel time costs are relevant (Wilman 1980). Because the method is based on variation in travel costs, however, allowance must be made for the time costs of travel. Although attempts have been made to include such costs (Cesario 1976; McConnell and Strand 1981; Smith et al. 1983 and Rosenthal and Hof 1985), their magnitude is still uncertain.

A second problem involves the functional form used in estimating the demand curve. Linear models, semilog models, quadratic models and double log models have been used for the travel cost model. Both Ziemer et al. (1980) and Vaughan et al. (1982), in comparing the first three of these, found the semilog specification best. There is evidence, however, that this model is not always adequate. Smith (1975) found that while both the semilog and double log forms were acceptable according to the conventional R^2 criteria, the Cox likelihood ratio test indicated that neither was reasonable in describing wilderness behaviour. Cheshire and Stabler (1976) found evidence that the semilog form overpredicts visits at extreme distances and underpredicts at middle distances. They suggested an asymptotic logarithmic form which involved an extra parameter – a constant added to the distance before the logarithmic transformation is performed. They also suggested that double log forms are illogical because they fail to account for either an upper limit (a limit to the distance at which there will be positive visits) or a lower limit (a limit to the visits that will be taken at zero cost).

The same considerations arise with respect to the functional form used for the marginal willingness-to-pay for quality, in the hedonic model. Because of the newness of the approach, however, there is very little evidence on the appropriate functional form.

Other potential problems involve multiple destination trips and congestion at recreation sites. In the first case, it is difficult to derive a value for the site apart from the remainder of the bundle. In the second case, the services of the site vary with the number of consumers using it. In both of these cases, determining the effect on recreation-site benefits involves modelling individual behaviour. Both cases need some study using disaggregated data on individuals in order to develop and test models that will incorporate such effects. Without such efforts, it is impossible to know if there are appropriate adjustments that can be made (Smith 1981).

The Use of Hypothetical Markets

Here, the approach is to confront the individual recreationist with a hypothetical market situation and have him respond to reveal his willingness-to-pay. These hypothetical situations are often called contingent markets. Although they are used for both user and non-user services, they will clearly be less hypothetical when used for estimating the value of user services.

Even for user services, design of contingent markets is never an easy task. The basic problem in designing contingent markets is to achieve valid and reliable revelation of the respondent's willingness-to-pay. Since willingness-to-pay questions are inevitably hypothetical to some degree, they are prone to errors in response. These can take the form of large variance and/or bias. In general, the major concern has been bias. This is at least partly attributed to the fact that willingness-to-pay researchers have often imposed sufficient structure on the questions they have asked to reduce variance to a manageable level. Attention is then directed to the question of bias. The types of bias that have been discussed in the literature include strategic bias, information bias, hypothetical bias and instrument bias (Rowe et al. 1980; and Schulze et al. 1981).

Strategic bias has tended to receive the greatest attention. Strategic bias will result if the respondent perceives he can affect the provision of the services, or the cost to himself of that provision, by giving a willingess-to-pay response that is different from his true willingness-to-pay. Although in principle it is possible to design contingent markets which do not provide incentive for strategic bias, in practice it is more difficult. Evidence suggests, however, that strategic behaviour is seldom observed. Concern with eliminating it may be unnecessary.

Other kinds of bias have also received attention. In one way or another, all types of bias stem from the fact that, because the contingent market is hypothetical, there is a cost but no benefit to the respondent of providing the correct answer. If the design of the question makes any other answer easier than the correct answer, bias can be expected. Hence we have such other types of bias as starting-point bias and instrument bias. In the former case, when an iterative approach is used to measure willingness-to-pay, the estimate obtained can be correlated with the starting point used in the bidding procedure. In the latter case, if the willingness-to-pay question is made realistic by relating it to the respondent's water or electricity bill, the response may be inappropriately correlated with the level of that bill.

Although bias is the type of response error with which researchers are most commonly concerned, it is not the only type of response error. The other type of response error that can occur when willingness-to-pay questions are hypothetical, is large response variance. As Thayer (1981) put it, "... the hypothetical exercise will not cause any specific directional bias, but rather may decrease rewards for accuracy, causing individuals to respond with meaningless bids". Large response variances decrease the reliability of the willingness-to-pay estimates.

Validation would make contingent market willingness-to-pay estimates more attractive. The best way of testing for validity is, of course, by comparison with actual behaviour. Unfortunately, comparison with actual behaviour is seldom possible. Bishop and Heberlein (1979) and Bishop, Heberlein and Keely (1983) have made the only such comparison in the literature. They found willingness-to-pay estimates to be biased downward. Other studies have attempted a form of validation by comparing willingness-to-pay estimates with estimates obtained using methods which use market information (Brookshire et al. 1981, 1982 and Thayer 1981). Some of these results are more optimistic. In general, however, the conclusion is that estimates of willingness-to-pay tend to exhibit some downward bias.[4]

---

[4]. Some studies have also estimated a willingness-to-take-compensation to forego a service. Bishop and Heberlein (1979) and Bishop, Herberlein and Keely (1983) found their estimates to have an upward bias.

Although there are difficulties and unknowns in applying the contingent market approach, progress is being made in designing contingent markets which avoid the response error pitfalls. To the extent that there is error, there is some evidence of its direction. The main advantage of this approach is that it can be used in a wide variety of circumstances. It can be used for valuing user services when market data are unavailable, and it can be used for valuing non-user services where there are no market data. It is to this latter group of services we now turn.

Non-Market, Non-User Services

A number of different types of values are included under the non-market, non-user, services category. These include option value, existence value and bequest value.

First consider the concept of option value, which was introduced by Weisbrod (1964) and has been refined by Bishop (1982), Freeman (1984), Graham (1981) and Smith (1983, 1984). Option value is an adjustment to the measure of consumer's surplus to reflect the uncertainty the consumer faces when future states of the world are unknown. The nature of the uncertainty and consumer's attitudes toward risk are key factors in assessing the importance of option value in any particular situation.

If the supply of a particular service is uncertain, and the consumer is risk-averse, a risk premium or option value may exist. For example, consider the consumer's surplus measure of def in Figure 2. The amount def is a conditional consumer's surplus which will accrue only if the service is provided. If there is a 0.5 probability the recreation opportunity will be provided and a 0.5 probability no recreation opportunity will be provided, the individual has a 0.5 probability of obtaining zero and 0.5 probability of obtaining def. One could say that the benefit the individual obtains from the uncertain supply of the recreation opportunity is 0.5 (def). This will not be correct, though, if the individual is risk-averse. If he is risk averse, he would be willing to pay less than 0.5 (def) for a 0.5 chance of the recreation opportunity. The amount less is the option value or risk premium OV. If one then asks what the consumer would be willing to pay to ensure that the recreation opportunity would be provided, that amount would not be def – 0.5(def) but rather (def) – 0.5(def) + OV. Hence, if the provision of a recreation opportunity can be seen as reducing risk, the option value is a legitimate addition to the estimate of the value provided. The type of case when this would be important would be one in which the continued provision of recreation opportunities (or their quality) is uncertain. If a guarantee of future provision is made, then that guarantee provides a benefit which includes an option value. If one used a contingent market approach to estimate the value of the guarantee, the willingness-to-pay answers should automatically include the option value. If, however, the value of the guarantee is estimated using market data methods, only def – 0.5(def) can be measured, and this measure has to be considered a lower bound.

Option value has also been discussed in cases where the consumer's demand, and not the supply of the service, is uncertain. It is unclear in this case, however, whether the option value should be positive or negative. It depends upon whether the consumer sees the situation with the service supplied, or the situation without the service supplied, as being more risky. Only if the latter situation is viewed as more risky will there be a reduction of risk with the supply of the service, and a positive option value. Again, any option value, whether positive or negative, will be included automatically if the contingent market approach is used. If the market data approach is used, it can be either an over- or underestimate depending upon whether the supply or no supply situation is more risky. As a practical matter, it is probably best to ignore option value in such a situation.

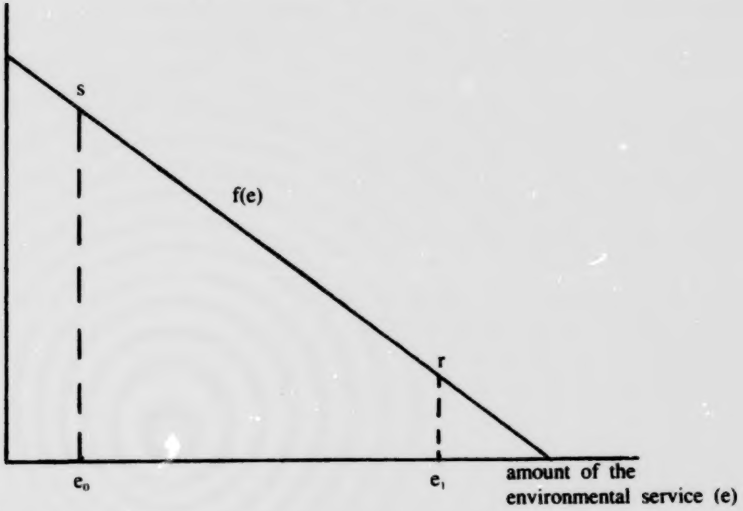
The other types of non-user values that are discussed in the literature are existence and bequest values. Krutilla (1967) suggested that people may value an environmental resource they may never use personally. This value may stem from a desire to provide something for future generations, or it may arise simply because the individual benefits merely from the knowledge that the resource exists. Both users and non-users may have these values, although one might argue that users may have higher existence and bequest values because they have a greater knowledge about the resource.

In general, the magnitudes of both existence and bequest values depend on the supply of the resource. If the resource contains species or ecosystems that are very rare, then one would expect that, at the margin, the existence and bequest values will be higher than if the resource contains nothing that is not plentiful elsewhere. This is assuming only that the marginal willingness-to-pay for a service for bequest or existence reasons, is a decreasing function of the amount of the service. Such a function f(e) is shown in Figure 5.

The f(e) function in Figure 5 says that if the service is plentiful (e_1), the marginal willingness-to-pay for another unit is small (re_1), and a small decrease in the amount of the service will cause only a small loss in existence benefits. If, however, the environmental service is rare (e_0), the marginal willingness-to-pay will be great (se_0) and a small decrease in the amount of the service will result in a large loss. Hence, concern with existence and bequest values should be greatest when the service is very rare and there are few available substitutes.

Figure 5

Marginal Willingness-to-pay for Bequest and Existence Reasons



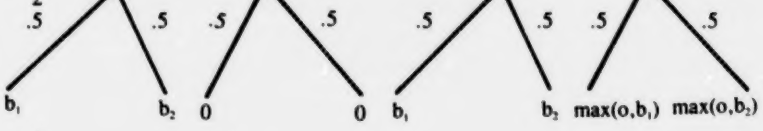
Except to the extent that individuals express their bequest and existence values in their market actions, such values must be measured by the contingent markets method. For non-users, the contingent market method is the only one that is available for measuring these types of values. Stoll and Johnson (1984) and Boyle and Bishop (1985) provide examples of studies that use the contingent market approach to measure these no-user values.

Quasi-Option Value

Finally, I will discuss the concept of quasi-option value. It is not a value derived directly from a consumer's willingness-to-pay, therefore requiring measurement, but rather a benefit that can be obtained from a flexible, decision-making process. It allows a decision-maker faced with uncertainty to take advantage of new information that may be generated by research investments or simply by the passage of time. It is most relevant to resource planners in situations where some of the alternative options available to them are irreversible and some are not.

Suppose we consider the question of a dam which would destroy a unique natural area, versus leaving the area as it is found. The benefits the area would provide, or the costs of destroying it, are currently unknown, but could be known in five years if the appropriate research was undertaken. Suppose we first consider the decision whether or not to build the dam, ignoring the possibility of better information on the benefits. Consider Figure 6a. In period 1, there will be $b_0 > 0$ benefits from the dam. All costs have been discounted from the dam's benefits, so the benefits from the no-dam alternative are zero. The state of the world in period 2 is unknown, but the probability distribution of outcomes is known. Net benefits of $b_1 < 0$ will occur with a probability of 0.5 and net benefits of $b_2 > 0$ will occur with a probability of 0.5. The expected net benefits of the dam are $b_0 + 0.5(b_1 + b_2)$. Assuming $b_1 + b_2 \geq 0$, it is clear that the dam should be built.

Figure 6



Now consider Figure 6b. In this case, allowance is made for the fact that, by the beginning of period 2, whether b_1 or b_2 will occur will be known. If we allow for taking advantage of the information, it will be necessary to reconsider, at the beginning of period 2, the decision made at the beginning of period 1. If the no-dam alternative is chosen in period 1, then the decision in period 2 can be either to build or not to build the dam. If the b_1 state of the world holds, in period 2 the decision-maker should choose the maximum of 0 and b_1 and not build the dam. If b_2 holds, the dam should be built because $\max(0,b_2) = b_2$. Viewed from the beginning of period 1, the net benefits of the no-dam alternative are $0 + 0.5 \max(0,b_1) + 0.5 \max(0,b_2) = 0.5b_2$. In theory, the same decision review should also take place on the build side of the decision tree. The problem is that the decision to build the dam is irreversible and it is not possible to take advantage of the new information. Hence the net benefits of the build alternative remain $b_0 + 0.5(b_1 + b_2)$.

There are two interesting conclusions:

1) A flexible decision process is more beneficial than an inflexible one if it will allow the decision-maker, at no cost, to take advantage of new information. The benefits of the flexible, no-dam decision are $0.5b_2$.

2) An irreversible decision precludes flexibility. When alternatives are asymmetric with respect to the degree of reversibility, the more reversible side will have an advantage in taking account of new information. In the above example, the decision whether or not to build the dam should be based on a comparison of

   $$b_0 + 0.5(b_1 + b_2) \text{ versus } 0.5b_2,$$

   not on a comparison of

   $$b_0 + 0.5(b_1 + b_2) \text{ versus zero.}$$

While it is clear that the extent to which keeping the options open is beneficial depends upon factors such as the discount rate and the cost of obtaining new information and its quality, it is also clear that, especially in cases where one of the alternatives is irreversible, it is worthwhile to consider whether the flexibility and the potential to improve the information base of the reversible alternative will give it an advantage in the comparison.

REFERENCES

Alberta. Energy and Natural Resources 1983. *A System for Integrated Resource Planning in Alberta*. Edmonton: Energy and Natural Resources, Resource Evaluation and Planning Division.

Bishop, R.C. 1982. "Option Value an Exposition and Extension". *Land Economics* 58: 1-15.

Bishop, R.C. and T.A. Heberlein. 1979. "Measuring Values of Extra-market Goods: Are Indirect Measures Biased?" *American Journal of Agricultural Economics* 61: 926-930.

Bishop, R.C., T.A. Heberlein and M.J. Keely. 1983. "Contingent Valuation of Environmental Assets: Comparison with a Simulated Market". *Natural Resources Journal* 23: 619-633.

Bockstael, Nancy E., W. Michael Hanemann and Catherine L. Kling. 1985. *Modelling Recreation in a Multisite Framework*. A paper presented at the AERE Workshop on Recreation Demand Modelling. Boulder.

Boyle, K.J. and R.C. Bishop. 1985. *Total Value of Wildlife Resources: Conceptual and Empirical Issues*. A paper presented at the AERE Workshop on Recreation Demand Modelling. Boulder.

Brookshire, D.S., B. Ives and W.D. Schulze. 1976. "The Valuation of Aesthetic Preferences". *Journal of Environmental Economics and Management*" 3: 325-346.

Brookshire, D.S., R.C. d'Arge, W.D. Schulze and M.A. Thayer. 1981. "Experiments in Valuing Public Goods". *In Advances in Applied Microeconomics*, ed. V.K. Smith, Vol. 1, pp.123-172. Greenwick, Conn.: JAI Press.

Brookshire, D.S., M.A. Thayer, W.D. Schulze and R.C. d'Arge. 1982. "Valuing Public Goods: A Comparison of Survey and Hedonic Approaches". *American Economic Review* 72: 165-177.

Brookshire, D.S., L.S. Eubanks and A. Randall. 1983. "Estimating Option Prices and Existence Values for Wildlife Resource". *Land Economics* 59: 1-15.

Brown, Gardner and Robert Mendelsohn. 1984. "The Hedonic Travel Cost Method". *Review of Economics and Statistics* 66: 127-133.

Burt, O.R. and D. Brewer. 1971. "Estimation of Net Social Benefits from Outdoor Recreation". *Econometrica* 39 (5): 813-827.

Cesario, F.J. 1976. "Value of Time in Recreation Benefit Studies". *Land Economics* 52: 32-41.

Cesario, F.J. and J.L. Knetsch. 1976. "A Recreation Site Demand and Benefit Estimation Model". *Regional Studies* 1: 97-104.

Cheshire, P.C. and M.J. Stabler. 1976. "Joint Consumption Benefits in Recreational Site Surplus': An Empirical Estimate". *Regional Studies* 3: 343-351.

Cicchetti, C.J., A.C. Fisher and V.K. Smith. 1976. "An Econometric Evaluation of a Generalized Consumer Surplus Measure: The Mineral King Controversy". *Econometrica* 44 (6): 1259-1276.

Clawson, Marion. 1959. *Methods of Measuring the Demand for and Value of Outdoor Recreation*. Reprint No. 10. Washington: Resources for the Future.

Clawson, Marion and J.L. Knetsch. 1966. *Economics of Outdoor Recreation*, Resources for the Future. Baltimore: Johns Hopkins Univ. Press.

Desvousges, W.H., V.K. Smith and M.P. McGivney. 1983. *A Comparison of Alternative Approaches for Estimating Recreation and Related Benefits of Water Quality Improvements*. EPA Report 230-05-83-001, March 1983. Prepared by the Research Triangle Inst. Washington: Environmental Protection Agency.

Freeman, A.M. 1984. "The Sign and Size of Option Value". *Land Economics* 60: 1-13.

Graham, Daniel A. 1981. "Cost Benefit Analysis Under Uncertainty". *American Economic Review* 71: 715-725.

Haas, Glen E., Deborah J. Allan and Michael J. Manfredo. 1979. "Some Dispersed Recreation Experiences and the Resource Settings in which they Occur". In *Assessing Amenity Resource Values*, eds. T.C. Daniel, E.H. Zube and B.L. Driver, pp. 21-26, *General Technical Report*, RM-68. Fort Collins: USDA, Forest Service, Rocky Mountain Forest and Range Experiment Station.

Heckman. J.J. 1976. "The Common Structure of Statistical Models of Truncation, Sample Selection and Limited Dependent Variables and a Simple Estimator for Such Models". *Annals of Economic and Social Measurement* 5 (4): 475-492.

Hotelling, Harold. 1949. Letter quoted by R.E. Prewitt in *Economic Study of the Monetary Evaluation of Recreation in National Parks*. Washington: United States Department of Interior.

Krutilla, J.V. 1967. "Conservation Reconsidered". *American Economic Review* 57: 777-786.

McConnell, K.E. and I. Strand. 1981. "Measuring the Cost of Time in Recreation Demand Analysis: An Application to Sportfishing". *American Journal of Agricultural Economics* 63 (1): 153-156.

Mendelsohn, Robert. 1984a. "An Application of the Hedonic Travel Cost Framework for Recreation Modelling to the Valuation of Deer". In *Advances in Applied Microeconomics*, ed. V.K. Smith, Vol.3, pp. 89-101.

______________1984b. "Estimating the Structural Equations of Implicit Markets and Household Production Functions." *Review of Economics and Statistics* 66: 673-677.

________________1985. "Identifying Structural Equations with Single Market Data". *Review of Economics and Statistics* Vol. 67. Forthcoming.

Mitchell, Robert C. and Richard T. Carson. 1981. *An Experiment in Determining Willingness to Pay for National Water Quality Improvements*. No mention of publication place/date. Washington: Resources for the Future.

Morey, E.R. 1985. *The Logit Model and Exact Expected Consumer's Surplus Measures: Valuing Marine Recreational Fishing*. A paper presented at the AERE Workshop on Recreation Demand Modelling, Boulder.

Rosen, Sherwin. 1974. "Hedonic Prices, Implicit Markets and Product Differentiation in Pure Competition". *Journal of Political Economy* 82: 34-50.

Rosenthal, D.H. and J.G. Hof. 1985. *Valuing the Cost of Travel Time in Recreation Demand Models: An Application to Aggregate Data*. Fort Collins: USDA, Forest Service, Rocky Mountain Forest and Range Experiment Station.

Rowe, R.D., R.C. d'Arge and D.S. Brookshire. 1980. "An Experiment on the Economic Value of Visibility". *Journal of Environmental Economics and Management* 7(1): 1-19.

Schulze, W.D., R.C. d'Arge and D.S. Brookshire. 1981. "Valuing Environmental Commodities: Some Recent Experiments". *Land Economics* 57: 151-172.

Smith, V.K. 1975. "Travel Cost Demand Models for Wilderness Recreation: A Problem of Non-nested Hypotheses". *Land Economics* 51: 103-111.

________________1981. "Congestion, Travel Cost Recreational Demand Models, and Benefit Evaluation". *Journal of Environmental Economics and Management* 8 (1): 92-96.

________________1983. "Option Value: A Conceptual Overview". *Southern Economic Journal* 49: 654-668.

________________1984. "A Bound for Option Value". *Land Economics* 60: 292-296.

Smith, V.K, W.H. Desvousges and M.P. McGivney. 1983. "The Opportunity Cost of Travel Time in Recreation Demand Models". *Land Economics* 59: 259-278.

Stoll, J.R. and L.A. Johnson, 1984. *"Concepts of Value, Non-Market Valuation and the Case of the Whooping Crane"*. Agricultural Experiment Station Article No. 19360. College Station, Texas: Texas A & M University, Dept. of Agricultural Economics, Natural Resource Work Group.

Thayer, M.A. 1981. "Contingent Valuation Techniques for Assessing Environmental Impacts: Further Evidence". *Journal of Environmental Economics and Management* 8(1): 27-44.

Tobin, J. 1958. ''Estimation of Relationships for Limited Dependent Variables''. *Econometrica* 26: 24-36.

Vaughan, W.J. and C.S. Russell. 1982. ''Valuing A Fishing Day: An Application of a Systematic Varying Parameter Model''. *Land Economics* 58: 450-463.

Vaughan, W.J., C.S. Russell and M. Hazilla. 1982. ''A Note on the Use of Travel Cost Models with Unequal Zonal Populations: Comment''. *Land Economics*, 58: 400-407.

Violette, Daniel M. 1985. *A Model to Estimate the Economic Impacts on Recreational Fishing in the Adirondacks from Current Levels of Acidification*''. A paper presented at the AERE Workshop on Recreation Demand Modelling, Boulder.

Weisbrod, B.A. 1964. ''Collective Consumption Services of Individual Consumption Goods''. *Quarterly Journal of Economics* 78: 471-477.

Wilman, E.A. 1980. ''The Value of Time in Recreation Benefit Studies''. *Journal of Environmental Economics and Management* 7 (3): 272-286.

Wilman, E.A. and P. Sherman. 1983. *Valuation of Public Forest and Rangeland Resources*. Discussion Paper D-109. Washington: Resources for the Future.

Ziemer, R.F., W.N. Musser and R.C. Hill. 1980. ''Recreation Demand Functions: Functional Form and Consumer Surplus''. *American Journal of Agricultural Economics* 62: 136-140.

AN OVERVIEW OF ECONOMETRIC MODELLING WITH APPLICATIONS TO RESOURCE MANAGEMENT

by: Dr. John R. Livernois*

Introduction

To understand and predict an actual system or phenomenon, scientists frequently use a geometric or algebraic model of the system. Because the model has fewer and simpler relationships than the actual system, it is easier to study. In addition, since the model, unlike the actual system, can be controlled by the scientist, experiments can be performed with it to provide valuable insights into the actual system.

Any representation of a real system constitutes a model but a good model must satisfy two additional criteria. First, it must have just the right amount of simplification. Second, the predictions of the model must conform to observations about reality. A model which satisfies these criteria can be an extremely useful input to a decision-making process. A model which does not satisfy these criteria can be a hindrance and can even provide misleading information. An example helps to illustrate these introductory remarks.

A road map is a geometric model of the land. As a directional aid to travellers, it helps guide the modeller to choose the correct amount of simplification. Because the topographical details of the land are relatively unimportant for a driver, they are excluded from the model. The highly complex land system is then represented as a very simple network of roads, cities and towns. This model is of great value in helping drivers move efficiently to their destinations.

A bad model would be over-simplified or too detailed, or would be an inaccurate representation of the actual system. For example, an over-simplified road map might show only primary roads and major cities, making it of limited usefulness. Conversely, a map which shows too much detail would be unmanageable because of its size, and again would be of little value. If the predictions of the model consistently failed to conform to observation, it would be a bad model. For example, a map might predict that if a driver follows route A, he will arrive at place A. If observation indicates that one consistently arrives at Place B after following route A, then the model fails to meet the criterion of conforming to reality.

An economic model is a simplified representation of an actual economic system or process. It too must have the right amount of simplifi-

---

* Department of Economics, University of Alberta, Edmonton, Alberta.

cation and must pass the test when confronted with reality. Finding the right degree of simplification is a mixture of judgment and science. Economic theory is the science which helps determine what variables ought to enter the model. While theory is a necessary condition for building a good economic model, it is not, unfortunately, a sufficient condition. This is where judgment and experience are helpful. Subjecting the predictions of the model to empirical testing is a science, one with which every economist should be familiar.

In this paper, I will provide an overview of econometric modelling. I will not discuss the use of economic theory and judgment in determining the right amount of simplification in a model. I do hope, however, that one can infer from the introductory remarks that an optimal model size does exist and that a good model is not necessarily a larger model. I will discuss only briefly the science of testing the econometric model although I will emphasize the importance of doing so. The focus of my discussion will be on explaining what is an econometric model and how it can be used and abused in forecasting and policy evaluation. Although the discussion will be general, I will conclude by providing examples of econometric models which have proven useful in past policy analysis, and by indicating what are potential uses of econometric modelling in integrated resource management.

Econometric Modelling

An econometric model is a special type of algebraic model. Suppose we are trying to model the process by which aggregate consumption expenditures are determined in the economy. A simple model is one in which consumption, C, is determined by aggregate income in the economy, Z. Algebraically, we can represent this in the following way:

$$(1)\ C = a + bZ$$

To quantify the model we need numerical estimates of the parameters a and b. In an econometric model, we recognize that the relationship in (1) will not always hold exactly in practice. Rather, there will usually be some prediction errors because consumption is probably influenced to some extent by additional variables not included in the model. Thus, the econometric model is stochastic because there is some random error involved in predicting consumption. We modify the model in the following way:

$$(2)\ C = a + bZ + e$$

where e represents a random error term which is equal to the difference between the actual and predicted values of C. Now, using data showing the historical relationship between C and Z, we calculate the values of the parameters a and b which minimize the sum of the squared errors. The resulting econometric model still contains prediction errors but they are the smallest possible.

Because the calculated values of a and b are only estimates of the true parameters, they too are subject to random error. This is the first point at which the model is tested. One way to do this is to construct a confidence interval (CI) for each of the estimated parameters. For example, a 95% CI for b places brackets on either side of the point estimate of b. The brackets are set so that there is a 95% probability that the true value of b is within the bracketed range of values. Generally, the size of the CI is determined by how well the model represents the real system which generated the data. A good model will have a small CI whereas a bad model will have a large CI. For example, suppose the point estimate of b is 0.5 but the CI is $(-0.2, 0.9)$. On the basis of these results, we could not reject the hypothesis that the true value of b is equal to zero since the CI includes zero. Thus, we could not reject the hypothesis that Y has no influence on C. Therefore, the data fail to confirm the prediction of the model. This is the most basic of the tests to which the econometric model must be subjected. If the model fails this test, it would be incorrect to use the model for forecasting or policy evaluation.

If the model is specified correctly, the errors will be randomly distributed about a zero mean. The presence of systematic errors is a signal that something is seriously wrong with the model. A common cause is the inadvertent omission of an important explanatory variable from the model. For example, between 1920 and 1960, the ratio of total energy consumption to gross national product (GNP) in the United States and Canada fell at a fairly constant rate (Berndt 1974). This empirical regularity might lead one to model the demand for energy in Canada as in (2) so that aggregate energy consumption is determined by aggregate income. Between 1960 and 1972, however, the energy-GNP ratio reversed its long-term trend and began to rise. The average annual growth rate of energy consumption over this period was 5.6% compared to 5.4% for GNP (Friedenberg 1979). Over this period, our model would systematically underestimate the demand for energy. From 1972 to 1979, the trend reversed again so that a declining energy-GNP ratio was resumed. Energy consumption rose at 3% per annum compared to 3.8% for GNP (Friedenberg 1979).

The omitted variable is the price of energy, which is a very important determinant of energy demand. From 1960 to 1972 the composite price of energy fell, while from 1972 to 1979 it rose quite dramatically (Friedenberg 1979). If the model were augmented to include a price variable it would eliminate the systematic error and thereby substantially improve the model.

I have briefly discussed two of the tests to which an econometric model must be subjected. If a model passes these and other rigorous tests, it can be deemed a good model. Then and only then should it be used as a forecasting and policy evaluation device.

Forecasting

There are a number of alternatives to econometric forecasting. Some are statistical; some are non-statistical. The simplest, and perhaps oldest, variant of the non-statistical approach to forecasting the value of a variable such as investment expenditures, is the survey technique. Here, the decision-makers themselves are asked to forecast their own future actions. This technique is likely to be useful when available data are poor. For this reason, I believe it would be a useful technique in many resource management problems where data are either unavailable or unreliable. I believe it can also be generally used to substantiate or possibly improve an econometric forecast. For example, the modelling of aggregate investment in the Netherlands has always had poor results. Indeed, Tinbergen (1981) states that, "In the Netherlands Central Planning Bureau we found it safer, after some years, to ask industrialists for their investment programs rather than rely on an econometric explanation....We may account for the lack of success by the fact that a small number of decision-makers determine the picture and that hence random deviations will be important."

The econometric approach to forecasting is based on the following general form of the reduced-form equation (Intriligator 1978, chapter 5).

(3) $Y_t = Y_{t-1}A + Z_tB + e_t$

Here, Y_t is a vector of g endogenous variables, Z_t is a vector of k exogenous or predetermined variables, Y_{t-1} is a vector of lagged endogenous variables, and e_t is the vector of g stochastic error terms. The t subscripts refer to the time period where $t = 1,2,...,n$. A and B are parameter matrices.

The model in (3) is based, ideally, upon an underlying theory of the system being modelled. Often, however, researchers search for a "good fit". That is, they will include any variables on the right-hand side of (3) that will increase the predictive power of the model over the sample period. Such an approach might lead to good fits, often due to spurious correlation, but are unlikely to lead to good forecasts.

A short-term forecast of values taken by the endogenous variables in the next period is given as

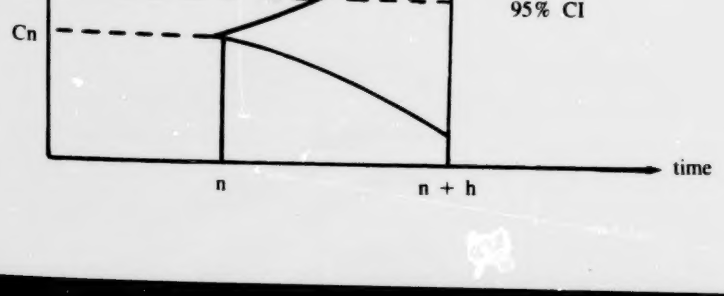
(4) $Y_{n+1} = Y_nA + Z_{n+1}B + e_{n+1}$

In this forecast of Y_{n+1}, we have two systematic components and one judgmental component. The first systematic component captures the dependence of each of the endogenous variables on previous values of all endogenous variables. The second captures the impact of the projected future values of the predetermined variables of the system. These projections are exogenous to the model but clearly form a very influential part of the forecast.

The third component is the judgmental component, ε_{n+1}, called "add factors". These are to capture the effects of factors not explicitly included in the model. For example, suppose we are forecasting production activity and the model has no explicit provision for strikes. If major union contracts are expiring and a strike appears likely, we would likely wish to adjust downward our forecast of production. Thus, there is room for using judgment at the forecasting stage rather than mechanically adhering to the output of the model. In fact, it would be inappropriate to overlook relevant information that ought to influence a forecast.

Medium- or long-term forecasts require predicting the values, Y_{n+h}, where h is the forward number of periods of the forecast. One way of accomplishing this is to make a succession of h one-period forecasts. The predicted values of each one-period forecast would become the lagged endogenous variables for the next one-period forecast and so on. In addition, the projected values of the predetermined variables are required for each of the successive h periods. I think this description of the long-term forecast is sufficient to indicate that the level of confidence in a forecast diminishes fairly quickly as h increases. While it is seldom done, it is possible to construct confidence intervals for forecasts which are extremely useful because they summarize the confidence with which the forecast can be made. Consider, for example, the simple, one-equation, econometric model discussed earlier, the consumption function in (2). In this model, there are no lagged dependent variables and only one predetermined variable, income. A point forecast of the endogenous variable is a prediction of a particular value, C_{n+h}. This amount is usually the expected value of the distribution of predicted values. A forecast confidence interval gives the 95% confidence brackets around the point forecast. In Figure 1, a hypothetical forecast confidence interval is drawn to show the "fanning out" of the interval as the forecast period increases and the relationship of the interval at n + h to the point forecast at n + h.

Figure 1



From a statistical point of view, there is a 95% probability that the actual value of C_{n+h} will lie somewhere in the confidence interval. This would constitute extremely valuable information to a policy-maker although it might appear as a severe limitation of forecasting reliability to someone who demands reliable point forecasts. Such an individual is bound to be disappointed with econometric forecasting because it is absolutely impossible to make highly reliable point forecasts. The best one can do is to use the available information at time N to predict the most likely outcome, and to indicate the probable range of outcomes, as demonstrated in Figure 1.

Thus, the first limitation of econometric forecasting is the tendency for the forecast confidence interval to fan out as the forecast period increases. Christ (1975) notes that the root mean square error (a measure of forecasting accuracy) for nine econometric models of the US economy typically doubles or triples going from forecasts of one quarter ahead to five quarters ahead.

A second limitation is that econometric forecasting can only be applied to areas in which there are a lot of reliable data with which the parameters of the model can be estimated and tested. Because data describing the no-market valuation of natural resources are sparse at best, formal econometric modelling will not be of much use in some areas of resource management. There are conventional sources of data, however, which describe the market valuation of natural resources (i.e. in production), so I expect econometric modelling to be a very useful tool in other areas of resource management. (This is discussed in more detail in the final section.)

A third general limitation of econometric forecasting is that the historical evidence of the accuracy of predictions indicates that models of macro-economies consistently underestimate change in the economy (Intriligator 1978). The fact that many models have this tendency suggests that it is not just a matter of omitted variables, as discussed above, but that some more fundamental forecasting problem is involved. To date, this problem has not been resolved.

Before finishing the discussion of forecasting, I should point out that, in spite of these general limitations, the record indicates that remarkable advances have been made in econometric forecasting. It is by now the most reliable method that exists to predict the future values of economic variables.

Policy Evaluation

A second major objective of econometric modelling is to evaluate alternative public policies. In this sense, the model is the laboratory of the economist. The experiments that are typically conducted are of the form, "what would be the response of variable Y, such as investment, to a change in public policy variable Z, such as the corporate tax rate?"

Since, as I suspect, integrated resource management does not involve fine-tuning of the fiscal structure of an economic environment, this application will be of limited use. Moreover, it is now believed that conventional econometric models are very poorly suited to policy evaluation of this type. The devastating argument, due to Lucas, can be illustrated with an example. Suppose we have a good econometric model of investment behaviour and we wish to know how investment would respond to a tax incentive of some type. We change the relevant tax variable in the model accordingly and then compute the predicted value of investment. This is how the policy of cutting taxes is evaluated by the model and it is the general method by which many types of policies such as exchange rate policy, interest rate policy and personal taxation policy are evaluated. An implicit assumption in these analyses is that the policy change is regarded as a permanent, once-and-for-all change. This is seldom true. More importantly, however, for the econometric model to yield a correct prediction, the change must be believed to be permanent by the economic agents, such as investors, whose behaviour is being predicted. This is probably never true.

In general, the criticism is that if one changes the policy environment, one changes the expectations of economic agents and therefore the structure of the econometric model. None of the large macro-models in current use incorporates this feedback phenomenon and, therefore, are all subject to the Lucas critique. Pioneering work is now under way to deal with the criticism. It will undoubtedly be some years before sufficient refinements are made and models, designed to evaluate policy alternatives, are generally accepted.

Applications to Resource Management

Resource management must deal with the problem of allocating the scarce natural resources of the province among competing uses. Normally, the price mechanism of the market performs this function. Because many natural resources have elements of common property and public goods, however, their market prices are far lower than their shadow value to society. For this reason, it is desirable to adopt an alternative allocation mechanism – public management. A good, but sometimes difficult, objective of public management is to try to simulate how the market mechanism would operate if all external costs and benefits were incorporated in the decision-making.

On a grand scale, simulating a market outcome is conceptually feasible but quite impractical. On a smaller scale, it can be a very fruitful practice. An example of such an undertaking is my work in the late 1970s on modelling coal development in northeastern British Columbia. In this instance, one of the costs that I considered to be external to the decision-making of the mining firms was the cost of constructing the townsite required to accommodate the labor force and its families. One of the questions which I wished to answer with the model was this: "If the townsite costs were incorporated in the mining firm's decision-making, how would it affect their decisions regarding coal development?" The first part of the answer was that the mines would only be developed at considerably higher prices than were being suggested at the time. The second part was that even if the mines were developed, they would be developed with a smaller capacity as a result of internalizing the townsite cost. This result is not at all surprising to an economist because a smaller mining capacity is associated with a lower labor requirement, hence a lower townsite cost. The model, however, provided estimates of the quantitative effect of townsite costs which turned out to be reasonably large.

I found two additional uses for the model which would apply generally in resource management. First, the model could be used as a benefit-cost device simply to evaluate a proposal of an interested party. Thus, I was able to estimate the size of the net economic losses associated with particular proposals to develop the coal mines. Second, the model could be used to evaluate alternatives that were not even being proposed. In particular, I used the model to examine the idea of staggered versus simultaneous development of the three coal mines to reduce the overall labor requirement for the area, and thereby substantially reduce the townsite cost. According to the model, this idea was good from an economic point of view.

I mentioned in the previous section that there appears to be potential for good econometric modelling on the production side of natural resource use. The potential exists simply because there is, in Alberta, as good a data base for industrial activity as there is anywhere. I consider research in this area to be important because some of the major resource users are industrial, including agriculture. They clearly represent some, though not all, of the competing resource users. While it may be a difficult task, and it is certainly an important one, to determine the value of natural resources in non-market uses, it is considerably less difficult to do so for market uses. Econometric modelling is well suited for this purpose.

The example I will discuss concerns oil and gas exploration, an activity which is very land-intensive. In planning for land allocation, it would be very useful to be able to forecast the level of exploration activity and the probable demands for land. In a recent study, an econometric model of oil and gas exploration was constructed (Livernois and Ryan 1985). The purpose was not to construct a model which would be useful for resource management, so its simplifications are different than those that would be appropriate for that use. Nevertheless, it illustrates the potential of an econometric model. One of our objectives was to estimate the elasticity of drilling activity and land acquisition with respect to the asset price of discoveries. The asset price of a discovery is, for example, the maximum price one firm might be willing to pay another firm for an undeveloped oil pool. It depends on the market price of oil, development and operating costs, taxes and royalties, discount rates, expected extraction rates and the size of the pool. Based on our findings, I have done a rough calculation of the elasticities of drilling activity and land acquisition to the market price of oil. In the 1970s, I estimated these to be approximately 1.4 and 1.5, respectively. These results indicate that a 10% drop in the price of crude oil is likely to lead to a 14% drop in drilling activity, measured in number of metres drilled annually, and a 15% drop in the amount of land acquired for exploration. Given the results in the model, one could use it to forecast, for a given path of prices, drilling activity and the desired level of land acquisition in oil and gas exploration. Similar exercises could be performed with econometric models of other industries that are significant resource users in the province.

The third example illustrates again the usefulness of an econometric model in providing a consistent framework for the analysis of private proposals for use of a public resource. Usually, proposals by interested parties emphasize the points that favor their cause, and normally do not include the external costs and benefits of their proposal. The econometric model can provide an objective and professional analysis of proposals of this type. Helliwell's analysis of the proposal to build a natural gas pipeline through the Mackenzie Valley to link Arctic gas to southern markets is an excellent example (Helliwell et al. 1974). The model enabled the authors to evaluate the claims of the Arctic Gas Consortium"...that some Mackenzie delta gas will be needed by 1980 for use in Canada, and that trans-shipment of Alaskan gas and substantial exports of delta gas are required to make a Mackenzie Valley pipeline feasible. Our results indicate that none of these claims is justified." In addition, the model was used to estimate the net economic losses associated with the proposals and to consider alternative proposals. In particular, the model predicted that Arctic gas would not be required before the late 1980s. Interestingly, the Berger Report, which received submissions from Helliwell, recommended a 10-year delay in construction for non-economic reasons.

I wish to conclude with a brief discussion of the economics of econometric modelling. In spite of the limitations of econometric forecasting and policy evaluation in general, and in particular areas of resource management due to lack of data, econometric modelling is highly valuable and very suitable to many applications in integrated resource management. It is also a costly undertaking. A very large investment of research time is required to construct, estimate and thoroughly test an econometric model to expose its strengths and weaknesses. Once in service, an econometric model requires constant attention, although this cost is small relative to the set-up cost. In order for the model to be useful, its users must be made aware of its abilities and limitations. To ensure that it is used properly, its operator should either be the architect or the architect's collaborator or assistant. Thus, the model should be constructed and operated by permanent staff members, possibly in collaboration with an outside expert.

REFERENCES

Berndt, E.R. 1974. "Forecasting North American Energy Demand: Issues and Problems." In *The Mackenzie Pipeline: Arctic Gas and Canadian Energy Policy*, ed. P. Pearce. pp. 71-79. Toronto: McClelland and Stewart Ltd.

Christ, C. 1975. "Judging the Performance of Econometric Models of the US Economy." *International Economic Review* 16: 15-74.

Friedenberg W. 1979. *Energy in Canada: Review and Outlook to 1995.* Study No. 5. Calgary: Canadian Energy Research Institute.

Helliwell, J., P. Pearse, C. Sanderson and A. Scott. 1974. "Where Does Canada's Interest Lie? – A Quantitative Appraisal." In *The Mackenzie Pipeline: Arctic Gas and Canadian Energy Policy*, ed. P. Pearce, pp. 197-227. Toronto: McClelland and Stewart Ltd.

Intriligator, M. 1978. *Econometric Models, Techniques, and Applications*. Englewood Cliffs, N.J.: Prentice Hall.

Livernois J. 1980. *Summary Evaluation of Northeast Coal Development in B.C.* UBC Resources Paper No. 53. Vancouver: University of British Columbia.

Livernois, J. and D. Ryan. 1985. *Testing for Non-Jointness in Oil and Gas Exploration: A Variable Profit Function Approach*. Research Paper No. 85-16. Edmonton: University of Alberta.

Tinbergen, J. 1981. "The use of Models: Experience and Prospects." *American Economic Review* 71 (6): 17-22.

WORKSHOP A: OPPORTUNITIES TO APPLY ECONOMIC ANALYSIS TO SUB-REGIONAL INTEGRATED RESOURCE PLANNING

Editor's Note:

This record of Workshop A was compiled from a paper prepared by B. Fardoe and the summary notes of the other three participants. A transcript was not produced.

Moderator: Andy Bowcott*

Integrated resource management is a strategy that endeavors "to optimize use of the provincial resource base to achieve maximum benefits for Albertans, now and in the future". This is clearly an economic efficiency objective.

This workshop has three parts to address this question. The first is a general discussion about integrated resource management and planning in Alberta. The second will focus on an essential aspect of sound decision making: appreciating the values and costs associated with alternative resource allocations. The third part of the workshop will complement the first. Here, emphasis will be on a discussion of social equity and welfare. This aspect of resource allocation and management considers the social impacts of government actions, and often carries greater political weight than strict efficiency.

---

* Planner, Resource Planning Branch, Resource Evaluation and Planning Division, Alberta Energy and Natural Resources, Edmonton, Alberta.

Integrated Resource Planning: A Review

by: Brian Fardoe*

There are ten resource management agencies involved in the integrated resource planning system. These agencies administer 25 pieces of legislation. The potential is high for conflict and duplication of effort.

Our definition of a resource is any element of the environment people perceive as having value, which varies over time. Integrated resource management is a management strategy that endeavors "to optimize use of the provincial resource base to achieve maximum benefits for Albertans now and in the future." I'm sure you've heard that about a dozen times these last three days, but that's the overall purpose of integrated resource management. It has a number of characteristics. It recognizes relationships among the various resource users and resource management agencies. We attempt to minimize the conflicts among these participants. It tries to promote positive interaction among participants, and the buzz words are "co-operation", "communication", "co-ordination" and "a comprehensive approach". Those four big "Cs" are the basis for integrated resource management. It is essentially a response to the specialization that has developed in the different resource management agencies in Alberta. Of the ten agencies, each has a specialized function. We've attempted to cut across those agencies and the resource sectors they represent.

The concept of integrated management originated in planning for the Eastern Slopes. Many of you are familiar with the recently revised Policy for Resource Management of the Eastern Slopes. The concept was originally developed or had it's roots in that area and has since spread throughout the province.

A key component of integrated resource management is integrated resource planning, a dynamic, continuous, sometimes-repetitive process of decision-making. It provides positive, future-oriented direction for a wide range of resource management activities. Integrated resource planning has the same principles as integrated resource management. It operates under that framework and it has characteristics consistent with that framework. We try to take an organized, systematic approach to planning. We attempt to provide the widest possible range of opportunities for involvement in planning. We provide a forum for discussion and development of planning initiatives and resolution of conflicts among participants. I should mention also that integrated resource planning deals only with Crown land and Crown resources in the province. We have a separate piece of legislation, The Planning Act, for planning of private land in Alberta. That process is handled by the regional planning commissions and municipalities.

---

* Planner, Resource Planning Branch, Resource Evaluation and Planning Division, Alberta Energy and Natural Resources, Edmonton, Alberta.

Energy and Natural Resources has a really high stake in integrated resource management, and has been a major proponent of the concept. We have management responsibilities for the 62 per cent of the province that is Crown land, and manage a wide range of resources including petroleum, natural gas, timber, fisheries and wildlife. Integrated resource planning and management has been incorporated in existing government structure.

I'll give a few characteristics of integrated resource plans. They provide direction through objectives and guidelines that state what we consider to be a desirable future condition and methods to achieve that condition. We provide geographic location for that direction using techniques such as zoning or what we call "resource management areas". In an attempt to be comprehensive, we have tried to identify the widest possible range of resource uses and values in an area. To date, most of the efforts in integrated resource planning have been issue-oriented. We've gone into areas where there were problems and have attempted to resolve them.

The direction in integrated resource planning comprises a four-level hierarchy. The higher levels provide direction for lower levels, right down to operational levels. The four levels are: provincial-scale resource planning at 1:1 000 000; regional scale at 1:250 000; sub-regional at 1:100 000; and local at 1:50 000 and 1:15 000. I'm involved at the sub-regional level which is what we'll discuss today. We're talking about an intermediate level of planning in which the areas range in size from 1 000 to 10 000 square kilometres. Ten thousand is unusual. There's only one area that large, while the average is about 2 500 square kilometres.

Most planning areas are concentrated along the Eastern Slopes. To date, we have ten sub-regional plans and one local plan in progress. A number of plans have been completed and are being implemented. The resource management agencies are implementing the plans.

The following is a rundown of the participants in integrated resource planning at the sub-regional level. We form a planning team of departmental representatives. The team provides a core that actually develops the plan. The team participants vary depending on the issues of interest in the planning area. We try to put field-level, resource management specialists on the team to provide local insight. They know the resources. They know what's happening in that specific area. The planners from Resource Planning Branch fulfill a co-ordinating function, facilitating the process. They solicit participants' objectives and guidelines and resolve their differences. The planning team, is responsible for overall development of the plan.

There are consultants to the team who are generally representatives of government departments and municipal authorities. Their function is to review and comment on projects as produced, and provide input to improve the overall quality of the plan. Again, the variety of consultants involved varies with the planning area. The consultants are kept informed, but they're not involved on a daily basis in the plan development as are the planning team members.

In the last three or four years we've been shifting into more public involvement. We started with the Alberta Integrated Planning Advisory Committee. It had six members, but is now up to ten members. Stephen Stiles is the chairman. We started with representatives from that committee at a planning team level: local members of the Alberta Fish and Game Association, the Alberta Wilderness Association, etc. They provided comments on plans in progress. More recently, we have moved into a much wider form of public involvement with open house meetings, information exchange sessions, this kind of thing. The public's function is to review and comment on the plan. They provide comments which the planning team evaluates, so that it may initiate changes to the plan. The team may also submit the comments to higher levels for consideration.

A complex review and approval structure has been developed for integrated resource planning in Alberta. It consists of, essentially, a series of committees starting with the ministerial level. Our representative on the ministerial committee is Don Sparrow, Associate Minister of Public Lands and Wildlife. These committees are inter-departmental and provide an approval procedure for the plans. At the cabinet level we deal with only one committee: the Economic Planning and Resource Development Committee. At the deputy minister level, the Natural Resources Coordinating Council provides direction. At the assistant deputy minister level we have the Natural Resources Advisory Committee. At the director level in head office we have the Resource Integration Committee. At the director level in the regions – ENR is a regional organization and a lot of the other organizations have regional representatives – there are Regional Resource Management Committees. The level with which I am most familiar is the planning team level. Each plan runs through this approval process. It's quite complex. A lot of time is needed to get through the approval mechanism, but we feel it provides everybody with a chance to provide their input. It increases support, obviously, for the product.

Though we attempt to be sequential and rational in our approach, we have provision to go back into our planning process if something comes up during the development of the plan. We produce documents at key stages and submit them for review by the various committees and the public. Our planning process is straight-forward. Plan initiation is followed by data collection and analysis, development of objectives, development of guidelines, consolidation of direction into a document, preparation of an implementation strategy and finally, plan review and revision.

I should also mention that, to date, one regional policy, four sub-regional plans and one local plan have gone to cabinet and been approved. The documents on the table outside are approved plans.

As I mentioned, the timeframe for development of plans has been significant. We've taken longer than expected because of the complexity of issues being addressed and partly because of the developmental stage of the system. Conflict resolution takes quite a while. It takes time for the planning team to gather information, apply it to a specific situation and sort out a solution that's acceptable to all parties involved.

Just a few points about the content of sub-regional plans. The objectives and guidelines in these documents have been relatively unmeasurable. The statements frequently indicated a direction or trend rather than specifics. Though we are tending to get more quantification and measurability in the planning direction contained in these documents, the actual direction in them now is not particularly measurable. This may have ramifications for the type of economic analysis that we would be doing in these plans.

This is the level we're all trying to get to – plan implementation where the plan is actually providing direction for resource management and public sector activity in a specific planning area. Implementation is done by government resource management agencies. If they've been involved in the planning from "square one", they have a much higher commitment to the product and are more willing to work with it on a day-to-day basis and attempt to implement the direction that's contained in the document. The specific approach we've taken is to try to elicit commitment in the agencies for the planning products. It's been a sales job, to a certain extent, for the whole integrated resource planning effort, but the concept has gained momentum over the last ten years and, as Les Cooke indicated, has evolved significantly.

The plans provide direction for assessing any kind of proposed action in a planning area – from a seismic program to a new recreational development, to timber development. Dispositions are the mechanisms used to control activities generally. The plan provides direction for the guiding of those legal dispositions – leases, licences, permits – used to control resource use in an area.

We've been preparing a companion document called the "plan implementation document" which outlines in more detail than a plan, government commitments, funding, resources and projects. The more detailed document will help field-level and regional resource managers to achieve the plan objectives.

That's a quick overview of what we've been doing. If there are any questions on specific aspects of the program, I could quickly answer those.

QUESTION PERIOD

PETER LEE:

Brian, I just have one question. Could you briefly describe the rationale for selecting planning areas?

BRIAN FARDOE:

The planning areas are selected on the basis of suggestions from the involved participants. We try to keep the size of the areas to something with which they would feel comfortable. Limitations on the size of the areas are data collection and this type of thing, how much information can you put together in a fairly short time. A parallel process in the Resource Evaluation and Planning Division is the ecological land classification which is usually done for a planning area. The size of those areas are a consideration – how much ecological classification work can be done in a specific time. The boundaries are really arbitrary, but we try to follow lines which are meaningful to participants. This is frequently a combination of administrative lines, ecological lines or rivers. There are no fixed criteria for designation of boundaries.

I should also mention that the long-term goal is to do some form of integrated resource planning throughout the province.

VALUATION

by: John Marczyk*

Background:

Alternative scenarios for resource allocation are developed in the planning process on the basis of a wide range of resource management objectives. These objectives are formulated by agencies of the Government of Alberta in the context of their legislated mandates. In order to choose among the alternatives to produce an optimal allocation scheme, it is well recognized that social and economic implications must be understood during the selection process. One difficulty of a statement of economic implication is deciding what aspects of the resource we should be valuing and what practical techniques are available to provide this information.

The Problem:

The problem, more specifically, is to determine the net present value (NPV) of allocation alternatives so that comparisons can be made.

Net present value can be defined as a single quantitative summary of all future, dollar-measured benefits less the costs for a planning alternative that can be compared directly with the net present value of other alternatives.

Objectives:

1. Determine what assumptions need to be made about the resource to be evaluated. What aspects of value (by resource) should be considered?
2. Determine what valuation techniques are available to determine the net present value of resources. What tools are there to do the job and which of these is the most practical?

Results:

The session was initiated with the assumption that it would be possible to address general questions on valuation for water, timber, range, recreation, fisheries and wildlife resources within an hour and thirty minutes. The assumption proved to be very optimistic. Initial discussion proved that the topic was quite complex. The ensuing discussion focused more on principles of valuation than on the mechanics of the task. The following conclusions were reached.

---

* Planner, Resource Planning Branch, Resource Evaluation and Planning Division, Alberta Energy and Natural Resources, Edmonton, Alberta.

1. **Market Values**: Establishing values using the market system works well when transaction information is available. For example, the value of a timber stand can be determined by examining royalty payments and value-added associated with similar stands. The inability of the market system to deal with non-market goods, such as wilderness recreation, adds a wrinkle to the valuation effort.

   Transaction evidence cannot be used to value the resource, so other measures of value must be found. Willingness-to-pay was introduced as a viable alternative.

   Both market and non-market goods were demonstrated to have user and non-user values. A recommendation was made and supported that emphasis be placed on user values in the integrated resource program for a start. As economics became a more sophisticated component in the program a logical extension could be made to non-user values.

2. **Accounting Stance**: The selection of the appropriate accounting stance is essential during valuation.

3. **Efficiency**: Economic efficiency is the primary objective of valuation. An attempt is made to determine the value of resources so that opportunity costs associated with allocation are known. The alternative with the highest net *social value* should receive first consideration.

4. **Quantitative Models and Techniques**: Quantitative models are useful in the valuation process because they force decision-makers to make decisions. The cost efficiency of such models, however, needs to be examined in the Alberta context. Alberta's economy may not justify the employment of FORPLAN as used by the USDA Forest Service. More cost-effective, quantitative techniques are needed to stay within the constraints of the program.

5. **Incrementalism versus Grand Design**: It would be better to approach the whole question of valuation and subsequent decision-making with a "learn as we go" philosophy. Little value was seen developing the grand design approach to valuation with payback well into the future.

6. **Participation**: Unanimous agreement was reached on the positive contribution to be made by resource economists throughout the Alberta government with respect to valuation. A recommendation was made that resource economists work with planning teams at decision points in the planning process.

EFFICIENCY/EQUITY AND OTHER CONSIDERATIONS IN INCORPORATING ECONOMIC ANALYSIS IN RESOURCE PLANNING

by: Dave Belyea*

Background:

The following notes were provided to participants before the workshop, to define its scope and stimulate preparation.

The overall objective of integrated resource management is "to optimize use of the provincial resource base to achieve maximum benefits for Albertans, now and in the future."

This is clearly an objective of economic efficiency, and can be addressed directly by the valuation techniques discussed in the previous session, applied within a benefit-cost framework. Such an analysis ignores distributional effects, such as regional economic development in relatively disadvantaged parts of the province. Such considerations often carry greater political weight than strict efficiency.

This example is only one of two more general questions:

- How should we incorporate other (non-efficiency) factors into economic analysis?
- How should we incorporate economic analysis into overall planning decisions?

More specifically:

1. What economic components, other than efficiency, should we be considering, such as distributional effects (regional development and transfers from rich to poor), income, employment, etc? How should this be done?
    - multiple-objective planning?
    - performing similar analysis with provincial and regional accounting stances?
    - other?
2. To what extent does consideration of social impact, income and employment overlap with benefit-cost analysis (double counting)? Does the use of two parallel forms of analysis amount to an effective bias against non-market values, since they are only considered in one form of analysis?

---

* Planner, Resource Planning Branch, Resource Evaluation and Planning Division, Alberta Energy and Natural Resources, Edmonton, Alberta.

3. How does/should the use of economic analysis in land use and resource planning differ from the analysis of specific projects? Is there a point at which analysis of uncertain, future opportunity costs and benefits becomes counter-productive, and is better left to specific, concrete projects when they are proposed?
4. How can the results of economic analysis be included in the existing integrated resource planning framework? In particular,
   - How can we avoid burying inherently-political choices in the technocratic "bafflegab" of economics, particularly in presenting results to the public?
   - How can the results of analysis be communicated most effec tively to senior decision-makers?

Results:

Much of the discussion dealt with the practicality and appropriateness of using well-established techniques, such as regional analysis, for addressing equity questions.

In sub-regional planning, the planning area is too small to be the subject of regional analysis techniques. A larger trading area must be analysed. Applying benefit-cost techniques within a planning or trading area accounting stance is one way to look at local/regional development benefits. It should be done in conjunction with the same analysis on a provincial accounting stance, so that regional distribution is not confused with net benefit to the province as a whole (i.e. efficiency).

Many planning decisions are choices among fairly well-defined, resource use options. Several participants felt that we would be a lot better off to use benefit-cost analysis (or other efficiency-based techniques) to spell out explicitly what would be the benefits and costs for each option. It is then essentially a political choice among net benefits and their distribution. Analysis should focus on whatever is going to facilitate that political choice. As well as benefit-cost, this analysis may involve spelling out the implications in terms of jobs, income and governmental fiscal costs (i.e. basically what has been covered in the analyses in plans to date). There was some discussion on the kinds of background information that could be useful to provide the required regional economic context for resource allocation decisions. This information could include employment trends by resource sector, basic demographic data, etc., most of which is readily available from Statistics Canada, Alberta Bureau of Statistics or elsewhere.

It was also suggested that resource management should focus strongly on efficiency. We will be creating tremendous problems if we, for example, make timber allocation decisions based on demands for local employment. Redistribution should be made according to other mechanisms, such as the tax system.

At the same time, participants recognized that distributional effects are often of *most* interest to politicians. One danger of focusing on equity is that management is reduced to responding to the ''squeaky wheel'': benefits are distributed in order to placate those who complain the most.

If any consensus emerged, it was that some relatively straight forward information on employment, income, etc. may be useful both for planners and for senior management, to put resource allocation decisions within a regional development context. The degree to which equity should be a part of our decision process was much less clear.

WORKSHOP B: APPROACHES TO APPLYING ECONOMICS IN REGIONAL INTEGRATED RESOURCE PLANNING

Moderator: John Brownlee *

First of all, I'd like to introduce the various people who will be leading the discussion. The first speaker will be Brian Chinery from the Resource Planning Branch. After his presentation we will have a panel address two basic questions. The panel members are: Alf Birch from Alberta Agriculture, Doug Webster from the University of Calgary and Mike Klugman from the Province of Ontario.

The two questions were given to the panel members yesterday so they haven't had a lot of time to think over the questions.

First, how would we incorporate economics in regional plans in Alberta? We would also like your comments on when economics should be considered, that is, throughout the formulation of a plan, or at the end of the planning exercise as an add-on.

Second, what techniques do you feel would be most appropriate, or most practical, in this instance? Do you consider that such techniques can be applied by planners or should they be applied by individual resource sector experts?

We're now hoping these gentlemen will draw on their experience and speak to these rather broad and far-reaching questions.

After the panel has discussed these questions, we will open the floor for discussion. The audience will then have the opportunity to discuss the initial points. We have a few other questions designed to round out the discussion. Susan Calp will be returning our results to the plenary session.

---

* Regional Resource Co-ordinator, Resource Evaluation and Planning Division, Alberta Energy and Natural Resources, Peace River, Alberta.

THOUGHTS ON REGIONAL PLANNING

by: Brian Chinery*

In March 1984, a regional planning program for ENR administrative regions was approved by the Resource Integration Committee (a committee which oversees public land planning). The intent was that plans should be in place soon to:

1. Co-ordinate the growing number of sub-regional plans.
2. Co-ordinate in the regions the application of a growing number of provincial land use and resource management policies.
3. Address practical conflict situations that normally occur among a number of competing uses of land and resources.
4. Set the direction for use and management of resources within each region.

Since 1977, the beginning of the resource evaluation and planning program in Energy and Natural Resources, we have focused on sub-regional planning of areas smaller than a rural municipality. A significant problem that occurs at the sub-regional level is the identification of provincial policies and their application to situations in the region. The regional plans must provide this direction.

All regions offer a wide variety of resource development opportunities. To some extent, all are affected by existing provincial policies and internal administrative policies. These policies are lumped together for the purpose of this discussion and referred to as provincial policies.

An often-used example is the Peace River Region. Its resource base is suitable for cattle, grain and oil seed-based agriculture, forestry, hunting and fishing recreational activities, and development of large oil and gas fields as well as significant oil sands. Other resources include low-grade iron ore and silica suitable for making glass. Generally, it is the intent of regional plans to provide for some development of all resources. In the case of Peace River, there is a sizable land inventory which will be made available for sale for agricultural purposes.

Part of the region consists of valuable wilderness areas and ecological reserves established by provincial legislation.

There is also a government commitment to new uses of hardwoods, which in Alberta means poplar. Reduction in the land base reduces the opportunities in forestry.

Each resource-managing department of the government plays a role managing a portion of these resources. The departments include Energy

---

* Planner, Resource Planning Branch, Resource Evaluation and Planning Division, Alberta Energy and Natural Resources, Edmonton, Alberta.

and Natural Resources, (which includes the Forest Service, Fish and Wildlife Division, Minerals Resources Division and Public Lands Division), Agriculture, Recreation and Parks, Tourism and Small Business and Environment. The mandates of divisions and departments, while aimed at benefits to the public, are often aimed at certain segments of the public perceived to benefit more than others from the expenditure of public funds. How economics could contribute to improve provincial and regional decision-making is the question of interest to the regional planners at this conference.

Regional integrated resource plans are a component in the existing system of integrated resource management and planning. The intent of these plans is to demonstrate how each region can contribute substantially to the provincial goal of maximum public benefit. Though not attempted in the past, the plans should provide a link between the more specific sub-regional plans and provincial decision-making. The regional plans would set general objectives and formulate policies to aid in policy conflict resolution, resource management and allocation of Crown resources.

Each regional plan will contain policies and programs for the best mix of Crown land and resource use acceptable to the public and industry. A regional plan will identify how each region's resources contribute to achieving the desired provincial development within the mandate areas of the Department of Energy and Natural Resources. It will specifically:

- Identify and allocate public land at the regional level and resource uses within the context of government policies and program,
- Identify resource management objectives for the region in terms of quantity, quality, timing, location and administrative elements,
- Identify opportunities as they relate to private, public or government interests to meet provincial goals,
- Balance provincial land and resource-related policies and objectives within the capabilities of the resource base in the region, now and with future demands,
- Assist the administrative divisions of ENR and other departments to evaluate development proposals,
- Rationalize the need for more specific levels of integrated planning, and
- Communicate to the public the land and resource management intentions of the government within each region.

Four regional planning projects will be conducted, one for each of the Peace River Region, the Northeast Region, the Central and the Southern Regions. Because we have an Eastern Slopes Policy, a regional plan has not been proposed for the Eastern Slopes Region. The plans will be limited to public land and resources though they will deal with private land within the scope of the department's mandate.

Economics is a component of regional plans that affects their acceptability to the government, public and industry. The consideration of economics stems from government interest in determining the efficiency and equity of resource management in the province. In addition, recent financial analyses of some sub-regional plans have implications for incorporating economics in regional plans. Chiefly, the position is that what has been done in sub-regional plans must be incorporated in regional plans. From this decision, we must now determine how to incorporate economics.

We have been advised to accept the methods of the Alberta Agricultural Land Base Study which will be outlined by Alf Birch. Our reticence on that score is due to the size of the regions, the lack of economic experience in the regional planning program, the concern that economics will further complicate the planning process, the number of resource sectors to be considered, the responsiveness of an economic analysis to change and our preference, because of time constraints, not to provide alternative resource allocations (resource scenarios).

The specific information we will have available in the projects includes:

1. Resource targets and their areal extent.
2. Provincial policies with their areal implications, and a limited number of regional policies.
3. A process to trade-off resource targets and adjust, for each region, provincial policy involving both the public and resource managers.
4. Decisions stemming from contemporaneous projects that may have a major effect on the regional plans; for example the South Saskatchewan River Basin Study and the Agricultural Land Base Study.

As with any new project initiatives, we seek to start on a path that will lead us to desired results. At the outset of our projects, we must convince others that the time spent to collect and analyse data will result in the desired product. Your insight and experience will help us develop the economic component of the regional plans and is greatly appreciated.

THE AGRICULTURAL LAND BASE STUDY

by: Dr. Alf Birch*

What I'd like to do is present a very brief outline of the Agricultural Land Base Study. It's one that you have heard about. A number of you are directly involved in it, and I have some fear and trepidation in trying to speak on behalf of the study. I'm certainly not the leader in any sense in that work. I think it has some relevance for the kind of questions you're considering. I'll try to summarize some of the key points I think are particularly relevant. I'll conclude with a few recommendations of my own about how economics might be incorporated into regional planning. I'd like to caution that these are just very tentative recommendations. I haven't put a lot of time and thought into them or discussed them extensively with others, but I'll throw them out for discussion this morning.

The Agricultural Land Base Study arose out of recommendations for a major conversion of arable forest land in northern Alberta for agricultural purposes. In response to that recommendation, a task force got together to discuss ways in which that alternative might be compared with other alternatives. Obviously, forest conversion to agriculture is not the only opportunity we have for promoting agricultural development in the province.

Out of that discussion came a list of 11 development alternatives that would be considered in the Agricultural Land Base Study. In terms of organization, the study includes participants from five departments: Energy and Natural Resources, Agriculture, Environment, Transportation and Municipal Affairs, the five primary departments having to do with resource management. In the process of evolving organization of the work in the study, we are now working primarily with two major committees, one dealing with a variety of physical impacts on the environment and resource base, and another dealing with the economics of those impacts.

The objectives of the study were outlined in the original terms of reference. There were really four primary objectives: first, to examine the potential for increased agricultural production under each of these alternatives; second, to do some economic evaluation of those alternatives; third, to investigate the impact of agricultural development on other resource sectors, thereby giving some further emphasis to agriculture being the driving force in the study, but recognizing that any type of development will affect other resource sectors; and finally, to express the results of the study in terms that are relevant with the policy development and further research.

---

* Head, Land Use Branch, Alberta Agriculture, Edmonton, Alberta.

The alternatives include:

- the expansion of agriculture onto CLI Class 4 land and Green Area, primarily in northern Alberta
- expansion of irrigation, mainly in the southeastern part of the province
- deep plowing of solonetzic soils
- liming acid soils
- reduction of summerfallow (some of these are farm management-oriented alternatives)
- flood control
- drainage
- improvement of prairie and woodland range
- conversion of prairie range to cultivated crop production
- conversion of woodland to cultivated crop production
- the reclamation of saline soils

These alternatives were selected to represent means in which physical limitations to agricultural production might be addressed. Now, there are obviously many other ways in which we could go about improving net farm incomes, or meet other agricultural objectives, but this study is directed primarily at physical agricultural development. These alternatives are being examined in a very parallel fashion. Each is being dealt with in the same manner.

When we ask what is the relevance of all this for integrated resource management, there are a number of points one can identify. First, we were given a limited number of alternatives to deal with, so we have 11 we're looking at in the study. We don't have 15 000 alternatives, we don't have one. It's significant we have a limited number. Those alternatives as they were given to us, however, were not defined adequately for analytical purposes. In other words, we had to get busy and ask, for example, what irrigation expansion means. Does it mean the very maximum irrigation production that could be anticipated? Does it mean a somewhat more realistic level of irrigation that would likely be developed? This obviously relates very closely with some work that Alberta Environment has done in their South Saskatchewan River Basin Study.

In terms of an alternative like deep plowing solonetzic soils, that was expressed as a treatment option really – deep plowing, not just any kind of treatment of solonetzic soils, but deep plowing of those soils. So we were limited to some extent in that alternative. What I'm saying is that alternatives were specified, but they needed further refinement, further interpretation.

Now, when we think of something like expansion of agriculture in the Green Area, the question has arisen, "does that mean with or without accompanying soil conservation programs?" While we recognize the potential for very significant soil erosion with major agricultural expansion, we made the decision to investigate the case with little or no soil conservation. In other words, we are going to be reporting fairly significant soil erosion hazards with that alternative, but conversely, fairly low costs. If we were to propose Green Area expansion *with* a soil conservation program in place, then we would report lower erosion hazard and somewhat higher costs. So again, we need to be very careful defining what the alternative is and reach mutual agreement on that score. I think that a large part of the issues that have had to be dealt with, in terms of managing this project, have revolved around refinement and definition of those alternatives. It's not an easy process but it's very, very necessary.

Related to this matter of the level of mitigation that goes along with a development alternative is the sort of technology we are thinking about. Is it a standard approach to this sort of development, or some sort of an innovative approach? Is it something with a higher level of mitigation incorporated? Related to the land base study, we have taken out the drainage component and dealt with it as somewhat of an independent study. In that research we are going after some innovative management techniques. In other words, one can drain land and not totally destroy wildlife habitat or totally alter the downstream hydrological system, and can prevent major flooding and erosion downstream through such things as either on-farm or regional consolidation of water. You drain sloughs on a farm, move the water over to the corner of the farm and put it into an impoundment area. Doing so improves the habitat enhancement there and possibly either largely or at least partially mitigates the habitat impact and still removes those obstacles in the field that are the farmer's main incentive for drainage in the first place. What I'm saying is that, along with the definition of alternatives, you have to ask whether this study is designed to look at innovative techniques or mitigative measures that could go along with the development, or whether we are just applying a standard development technology that would accomplish the purpose but might have much higher impacts on other sectors.

In terms of the economic analysis in the study, the original terms of reference just ask for an investigation of the economic benefits. Again, that aspect needed to be refined somewhat and expanded, and we have come up with a number of economic indicators. In the economic section of the study we have done both economic and financial analyses. If you have some familiarity with those terms, financial analysis means, from the point of view of the farmer, what his costs and returns are going to be. Economic analysis is concerned with the social point of view. In other words, taxes don't really matter from a social point of view. You're taking money from one group and transferring it to another. It doesn't really affect economic analysis, but it certainly affects the farmer. Taxes are a cost to a farmer, not to society.

Now the first category here, the acreage, really isn't an economic measure, but I put it in because it relates to some of these other indicators: annual cash flow on a dollar per acre basis – what this alternative will look like to a farmer, the total direct benefits, the total net present value. When we take the total number of acres we have available for a development alternative, and the per acre returns, and convert that into present value terms, what are the total benefits that this development alternative is going to produce? In addition, another factor is some indication of the secondary benefits. We have heard some discussion of whether or not those ought to be included. I think in the case of this study there is some justification for putting them in, because we are putting them in not only for agriculture, but for fish and wildlife, forestry and the other sectors we are considering. There's a balancing on both sides. If you say it's unlikely that secondary benefits should be there, at least we're dealing with it fairly. We're not weighting the results in favor of agriculture. Then our direct plus secondary benefits give total economic benefits.

Public investment costs are quite significant in terms of both northern expansion where there are major infrastructure requirements, roads and utilities and so on, as well as for irrigation and drainage development. Considering the opportunity costs, or foregone benefits in other sectors, is just putting into economic terms what is going to happen for the other sectors as agricultural development takes place. Those costs are counted as "costs" in the study. Agriculture is being counted as the benefitting sector, but if the costs, in other words what we're giving up elsewhere, are greater than those agricultural benefits, obviously the development alternative doesn't look good from a social point of view and we wouldn't recommend going ahead with it. The net benefits in the study are total economic benefits minus public investment costs minus opportunity cost. We can express net benefits on a per acre basis. In other words, the total net benefits for irrigation are not all that great. On a per acre basis it looks very good because we're not dealing with a lot of acres for irrigation, but the potential for increasing production is quite high.

We are also attempting to give some regionalization of those results. The study in its full extent is a provincial study. Some of the alternatives are obviously regional in nature. Irrigation is not a province-wide option. It's largely located in southeastern Alberta. Some of the other alternatives spread across regions so we want to identify in what regions where those benefits are taking place. We can do that with the direct benefit though it's very difficult to do with something like secondary benefits because of the spinoffs throughout the provincial economy. To some extent we can deal with public investment costs and opportunity costs on a regional basis.

The study is being conducted on a basis of representative enterprises. Refer to comments yesterday regarding the building blocks with which we work. This is certainly the way we've had to go about this study. We can't study every farm in the province obviously, so we analyse representative farm enterprises for the different regions or the different soil zones. The same has happened with a number of forest reserves. They've taken representative logging operations and mills to use in the analysis. When it comes to fish and wildlife analysis, it's more difficult to conceive and analyse what you might call a representative enterprise – hunter trips perhaps. I think the recreational and wildlife area is the one that needs to be developed further. I've certainly received an appreciation in the last little while as to why this might be the case, given the difficulties of evaluating intangible benefits.

Finally, I think we have achieved consensus in our interdepartmental committee. We've achieved consensus on methods, on the types of assumptions we want to draw and on some of the parameters we're all going to use. I would like to see this process continue. It may be possible in the future to come up with some sort of standards for doing benefit-cost analyses in Alberta. I don't think we have that consensus yet, but we're working in that direction.

What would be my recommendations for incorporating economic analysis in regional integrated plans? I've tried to emphasize already the importance of carefully defining the alternatives we're going to study. It's very, very difficult for an economist to adjust things a little bit one way or the other way as you might drawing lines on a map. While you can move a line over, the economist has a bit more trouble studying alternatives if they're not really defined. So I would suggest that each of the major sectors participating in the regional planning exercise define an alternative that is best for them; what would they really like to see in that region? Let's take agriculture for an example. We would define our best alternative in central and southeastern Alberta. What is the consequence for the other sectors of that number one choice for us? Similarly with forestry, if the foresters want to define a best alternative for themselves, what is the consequence for agriculture, or fish and wildlife? So in a sense you have a matrix of alternatives.

This brings to mind what John Hof described about the layout of that linear program model. Obviously, there are a lot of activities and a lot of management alternatives. In a sense, what I'm suggesting is something conceptually similar where you have alternatives that are primary or preferred for each sector. That idea would have to be supported with a good deal of resource inventory work so that we can tell, for example, if agriculture is going to expand to its maximum potential here. We would know the types of areas that are required and the impact on habitat or on whatever other sector we might be considering. We need to be careful in defining what those trade-offs are for each of those alternatives. Where one sector is being touted as primary, what are the trade-offs for the other sectors? I think that a planning group like Resource Evaluation and Planning could co-ordinate and lead the investigation of the trade-offs that would be required.

When that has been accomplished, and if you have some economists involved throughout that process to say "yes, I can deal with the kind of information you're producing", then the economic analysis comes in at the end to put values on each of the scenarios you've defined. Taking one sector as primary and counting the others as opportunity costs, what are they losing from their best alternatives? It gives something that is logical to deal with. The economists can work with that kind of a conceptual framework. If he's included along the way, he can alert others to the information requirements he's going to have when you get to the end and begin to apply economic values. At each of those stages, defining alternatives, investigating the trade-offs and doing the economic analysis, there can be both public and political input or discussion. An interdepartmental committee such as we have worked with in the land base study is a good way to go. It's not an easy sort of vehicle to manage. I'm sure you have more experience than we do in that regard. The final result is better if you have input from a number of departments and can maintain their commitment to the process and the final product throughout. In terms of having done an agricultural land base study now, many of the departments have gone some way to doing the kind of investigation you're going to want to build on here. We have done a provincial study, but we've done it in terms of regional components in a sense. So when you come to doing regional integrated management studies, some of this work has already been done by at least some of the agencies. For others it may be more difficult or they may be further back in the process, but I think it's a task that can be done. Some of the departments are, in fact, moving toward having regional priorities. For example, in agriculture we would be able to say irrigation is our only alternative, or our only priority in southeastern Alberta if that's the case. Because we have studied it on a provincial scale, we now know what trade-offs we can begin to make at a regional level. If I understand correctly, that's one of the answers you're wanting to begin to receive from the departments so we can, in a regional context, consider provincial policies and priorities.

PUBLIC RESOURCE PLANNING AND ECONOMIC ANALYSIS

by: Dr. Mike Klugman*

I have a very few, shall we say, introductory statements. My main contribution to this group is, I hope, to hold your hands in the discussion and walk through it. I've brought some of the background material and the final products of what we went through in Ontario in coming up with these land use guidelines, as we call them, or plans if you wish. Relative to the economic aspects of it, to me economics is a built-in facet. The bottom line in all our jobs as civil servants, and I assume Alberta is the same as Ontario, is the economy of the province. We tend to forget that fact. We tend to get lost in the trees or in the lake with the fish. So, in any exercise of this nature, the economics are a fundamental part.

I am not an economist, but I don't think you can go through the planning process without addressing the economic aspects of each alternative. Now some of them are obvious, some are not obvious, and they involve a certain amount of additional study and the expertise of economists. Basically, I don't look at the economic considerations as something separate in creating a plan. I look at it as something that's totally integral to the process. Likewise, I look at each competing interest or sector as a fundamental part of it. You may say, well, the prime objective here is forestry. But you don't say this is forestry to the exclusion of everything else. You have to look at it and ask what is compatible with this use? What can we relate to it?

I'll refer to the term "sequential use". When you start getting into the exploitation of, shall we say, non-renewable resources like quarries, pits and aggregate, you have to look at it as a sequential use, a multiple-use. I don't frown on multiple-use because it is a very real consideration. You'll find that most land is in multiple-use. There's a prime use, but also other uses.

The most important aspect to me, and this probably comes from bias, is that the creation of these plans should be done by the people on the ground. The plans should not be created in an ivory tower in Edmonton. Of course I'm speaking from a different scenario, a different management structure, but the people who know the most about an area are the people who are actually on the ground. This way you will go through the creation of a plan with the least heartburn. There is going to be a lot of heartburn. You will have competing interests right in your office, out there in the private sector and with the public. You have to go step-by-step in concert with everybody who's involved. So I can't really speak specifically to the fact that economics should shine as a guideline or light. I can't espouse any particular sector. They must all be studied in concert by people who live with the various conflicts and, shall we say, compromises of the area. Economics is a fundamental aspect. I don't think we should make a big deal out of trying to separate it, because the moment we try that we drive the whole approach to planning out of proportion. Economists must be a part of planning.

---

* Regional Director, Northeastern Region, Ministry of Natural Resources, Sudbury, Ontario.

TECHNIQUES OF ECONOMIC ANALYSIS IN REGIONAL PLANNING

by: Professor Douglas R. Webster

I have not given this topic a lot of thought at the regional scale, although Craig Taylor, Keith Leggat and Brian Chinery visited the University of Calgary a couple of weeks ago and we spent the afternoon probing it. I reserve the right, if you ask me for advice on this topic in another week or two, to contradict completely everything I say today. I am not yet ready to lock myself into a concrete position.

The techniques used at the regional scale should be different from the ones used at the sub-regional scale. Obviously, your group is a lot farther down the road, about two years further, in terms of economic/financial analysis at the sub-regional scale than at the regional scale. The regional scale is a rather new scale at which to be working. It is tricky for several reasons, although historically, it is the one I have worked at more in Alberta. What your division is doing is looking at Crown land. Another group of institutions, the Regional Planning Commissions, are planning the settled, freehold land. It is not an easy distinction to make in practice. Obviously, resource development affects the settlements of the province, and vice versa, activities on the settled, freehold land affect what happens on the Crown land.

I want to say a few words concerning what constitutes a regional plan. You cannot talk about the economics of regional plans until you know what they are. Basically, I agree with the guidelines that Craig Taylor and his staff have formulated to this point. I do not think anybody advocates master planning at the regional scale any more. What is needed is a guideline approach, as Mike Klugman's ministry has effected in Ontario and we have done here in Alberta in terms of planning at this scale in the past. At the regional scale, you do not want a static, master plan. What is needed is a regional planning process that is constantly identifying opportunities and constraints as conditions change in the world. That does not mean you do not produce documentation such as exists for the Eastern Slopes. It is necessary for people to understand the existing situation and to know what the future is likely to resemble. As you know, for political reasons you produce a document. That is what planners do. It is equally important, however, that there is a consistent, on-going regional planning process in these regions.

It seems to me that the approach to take is what the British would call an "indicative structural approach". There are certain things you can master-plan at the regional scale; for example, a transportation/communications corridor. Or, you may know there is going to be a large pulp and paper complex in a certain town in five years, and you can master-plan it. (The multinational companies and the Government of Alberta, have made a deal and the plant is on the way.) Another example is a wilderness area that has been designated as such. You know it is there. In summary, some components you can master-plan, and what you can master-plan, you should. This is what the British would call "the structure" of your regional plan.

The leftover "messy stuff", where it is still "up-for-grabs" between, for example, agricultural and wilderness land use, must be dealt with in an indicative/guideline type of way. This approach will apply to most of the land area in many cases.

At the regional level, areas should be designated for certain kinds of decisions. In many cases, trade-offs will have to be made. In the north, as Alf Birch said, often the trade-off is between agriculture and forestry. Or it may be a trade-off between wilderness use and much higher-traffic tourism. On maps and in reports, one can identify these kinds of decision areas in terms of a spatial perspective.

The other function a regional plan should perform is to make some very general allocation guidelines. For example, roughly X amount of land should be for wilderness, Y amount for farming, Z amount for high-traffic tourism, or whatever. In undertaking this type of analysis, incompatabilities should be identified. The concept of irreversibilities is also important. There are certain actions that change the resource base permanently. Such actions should be identified and discussed in the regional plan.

Let me discuss the role of economics in this model. In terms of economic and financial analysis at the regional level, you should not be doing the kind of project-scale analysis dealt with in other papers. What should be undertaken at this scale is regional allocations, regional economics. The benefit-cost analysis of a specific project is done more properly at the sub-regional level, as indeed you have been doing it, or even at a specific project level. The question is, should some quick, fast, and dirty socio-economic/financial analysis have been incorporated in the plan-making process? My answer on that is simple – yes, it should be. A "cash register" approach to planning should not be taken.

If we are talking about the regional level, about identifying opportunities, and identifying allocations, the first thing one needs to know is what (and how much) resources and services will be valued in the future. You should not generate this information yourself. It is very expensive to generate and some people are doing it fairly well already. For example, the commodity futures projections of the World Bank are the best there are. For services like tourism, UNESCO has some good data. Somehow, the analyst must make some estimates of future prices for resources (and services related to resources) and future demand for them.

As I mentioned yesterday, the other type of starting point information you need is to have generic modules so that you know, for example, what a pulp and paper mill or a certain kind of forestry operation or land settlement means, in terms of economic financial, employment and social impact. Most of this information is around. There are many analogous situations in this province and in Canada. Again, this task is more a matter of putting together an information bank – nothing fancy – or knowing where the information is located. For example, in Alberta Agriculture, it appears from what Alf Birch was saying that he has some generic modules. From the sub-regional work Energy and Natural Resources has done, there are modules around. Once you have found material, which I call your starting point information, i.e., your basic, long-term trend information and modular information, the next thing you should do is survey the economy as it relates to resource activity. The point that people have been making at this conference, and I agree, is that when one is dealing with resources and resource development, you cannot limit your economic analysis just to the primary sector, that is, the value of logging trees or growing food. You must trace these chains through the value-added processes that will occur in the region in question, or in Alberta for that matter. I assume that many of your regional plans will encourage more value-added activity within the region in question. You have to trace these chains. Often the majority of value-added, as any farmer will tell you, is not in the primary production or harvesting of a resource but farther down the line. This is one of the main concepts to keep in mind when you are doing economic analysis.

Most of the techniques available for surveying an economy, in terms of its use of resources, are fairly standard. The techniques have been around for a long time; there is considerable relevant literature. The planner should look at the mix of activity in the region in terms of the industrial/employment/occupational mix and breakdown, and the linkages between them.

There is some debate about including the so-called secondary benefits which are accurately called "induced benefits" in regional resource analysis. (The contention exists because *all* projects produce induced benefits. Induced benefits tell the analyst more about a region's economy than the project being analysed.) People purchasing personal goods and services create these benefits. There is no debate about including the so-called linked activity which is the inputs and outputs to a resource activity. It is very important, therefore, to trace the linked activity and identify it. That is one way to identify new opportunities. This kind of information, particularly on potential linkages and future world prices, should lead to identification of a set of opportunities in the region.

In terms of the regional planning process, there are two ways to go about it. You could take the approach that you have taken in the Eastern

Slopes, that is, to make some decisions and recommendations about the region's resources. Or, you could come up with a shopping basket of possible activities or some scenarios vis-a-vis different ways the region could be planned. At any rate, once you identify some possible land uses or resource allocations, you would identify the employment that would come from them, again using standard socio-economic impact techniques. One technique, "industrial complex analysis", is very useful. It traces the potential linkages (the input/output linkages) from an activity; you could then identify other activities that are likely to be based on the core resource activity. This approach is in tune with the political times; increasingly there is a developmental orientation. The identification of opportunities that come out of some of your core resource activities would be a component of your regional planning process. At the regional level you do not need to be too fancy about identifying these impacts. You want to identify correctly the direction of change and the order of magnitude. In Alberta, almost every time we do resource analysis, we use a different software model, a different model to generate a multiplier, etc. Therefore, little that we do among departments, sometimes within departments, is comparable. The negative impacts of this problem are greater than the error factor you would have if you just used a consistent set of techniques for a given region and all departments used them. There is potential here for your ministry to be the leaders and to standardize some of the assumptions we make and techniques we use. In other words, comparability of these studies is probably more important than accuracy, because the error would be constant if we used the same assumptions and techniques in our work.

I want to respond to what Alf Birch said. I am going to disagree with him to get this discussion going. He proposed a method where, in effect, each department would put forward a scenario that was best from their sectoral interest. This approach will ensure that you have very sub-optimal plans. Maybe what he meant was that these scenarios should just be starting points in the regional planning process. I could see using them as starting points, then bargaining from that level. But I am almost positive that plans that are closer to the optimal (we agreed yesterday that planners never achieve the optimal) would obviously involve a lot of tradeoffs and compromises between competing sectoral empires. In my opinion, the way to go about it is not to go through the sectoral step but rather to go more directly to what would seem to be the more sensible integrated scenarios. I think this is the way the planning teams in Energy and Natural Resources work already. That is, make some obvious, common-sense trade-offs right away before starting to do the detailed work. Using planning and welfare economics jargon, move onto the "hills" that are not single-sector "hills" in doing this kind of analysis.

In my opinion, an indicative approach is the only approach to take. These regions are large and very difficult to deal with even considering all the computer-aided technologies, land inventories, etc., that are available. Les Cooke made this point during the first day of the conference. Human and economic behavior is so complex in a region that allocations are going to have to be very "broad brush". In a sense what you are doing is identifying issue areas spatially and substantively to be dealt with at a lower spatial scale in much greater detail. That is why many of the project-oriented techniques are not at all applicable at the regional scale.

GENERAL DISCUSSION

Editor's Note:

Because the tape recording of the discussion did not turn out very well, comments have been edited substantially or paraphrased to bring out a main point and hopefully provide some continuity.

JOHN BROWNLEE:

At this point I'd like to suggest that if you have any questions relating to the panel's presentations or some questions of clarification, now is the time to ask them.

ALISTAR CRERAR:

My question is directed at Doug Webster relating to your suggestion that we do rough demand and price analysis. It's extremely difficult to do. Wouldn't it be an adequate substitute to try to identify the lowest-cost price for forestry, farming or the other kinds of uses, then identify where the margin is set? The lowest-cost price would be the good forestry price. It wouldn't even be the price including the distance to the mill, and it becomes the one that should be the highest priority from forestry's point of view. We should also look at coal development or agricultural use very heavily in most circumstances. Then, as we get 15 to 20 miles away, forestry becomes more tolerant of other uses in fact, we have to assume there will be a demand for forestry at some time. As long as a lost-cost producer remains, he'll be able to get a share of the world market whatever it happens to be. What do you think about that approach, as an alternative, to try to identify the marginality of price?

DOUG WEBSTER:

I don't think the two approaches are inconsistent. I would still try, obviously, to get the best futures information on price demand. It's anybody's guess what you'll get five or ten years from now. What you're saying essentially is that a sensitivity analysis should be done at a certain point where one factor or another takes effect. Some futures information makes it possible to plan ahead. You need to have some guidelines as to where the cutoff is going to be. I don't see it as an alternative approach, but as a way of dealing with regional difficulties.

WALTER URQUHART:

It appears to me there has been no debate at all on an overall integrated resource policy being formulated. If there is no policy, why not, and can someone tell me about it?

JOHN BROWNLEE:

Obviously, you're not the only one who has an interest. I'd like to keep you on track in terms of regional planning and its relationship to economics, but we'll address your question. I think Les Cooke and possibly Craig Taylor would be in the best position to deal with it.

LES COOKE:

If we expect at some point to have a totally integrated, provincial policy setting, we will be waiting a very, very long time. What is happening in Alberta that is fundamental to being able to do regional planning is development of a much more explicit policy approach, such as a wildlife policy, coal development policy and agricultural land use study. When we get to the point where we have each of the sectoral policies in place, we can draw from those the information we need to do regional and subregional planning. I would not expect, particularly, to take those major sectoral policies and, without a great deal of effort, actually integrate the policies. I recall a paper that Alistair Crerar gave a couple of years ago, in which he said we need to have some clarity in some areas of provincial policy. The example given was more explicit statements of priority in the province. If we can get provincial policies to the point where we have explicit statements of sectoral policy, I think we'll have the ingredients we need. The process of integration does require some geographic sensitivity which is how we bring things together.

DOUG WEBSTER:

The real problem is you get a lot of double and triple counting. This aspect shows up, for example, when you are talking about opening new land for agriculture, such as in the Jean D'Or Prairie Plan. When we looked at it, we knew basically what was the potential farmer's demand for new agricultural land. We didn't know whether there would also be land opened in the Big Bend planning area or in other areas. Everybody assumes that they will meet the demand within their own sub-area and you get double and triple counting.

When I was in British Columbia co-ordinating an economic study and looking at steel mills, with some people in Economic Development, we put one in every region because there was no provincial framework stating one region instead of another.

One of the most important roles of the regional plan is, in effect, to "divvy up" the provincial pot. If there's so much demand for forest products, at a certain price as Alistair Crerar was saying, where will the development occur within the province? This is a very important role for regional planning to handle. As Alistair said, you're dealing with spatial planning. When the price goes up for some products, like forest products, the land use implication would be more or less linear. They'd just cut more trees and go farther and farther out. In terms of other resource activity, though, like agriculture, instead of having a linear relationship with land use, people might substitute more capital. The relationship between prices and demand in your land users is going to be very tricky depending on whether it becomes more land intensive or more capital intensive.

MIKE KLUGMAN:

You have to use a step by step planning approach as we did in Ontario, going from background information to policy and to strategic land use guidelines. You take a large plate, work it piece by piece into manageable units, and produce guidelines rather than a plan for each unit. Guidelines are dynamic as opposed to static, like a plan.

CRAIG TAYLOR:

I have a question that relates to the provincial-level situation and the techniques for doing regional plans to achieve some of our general objectives. We generally work on the same principle as Ontario. We ask our line divisions and departments what their objectives are, what their goals are at the provincial level, then try to get the agencies to identify where those objectives would be applied in a region. That's what I would call the objective approach – what our objectives are. Then we'll find out whether we can make a new map either by the resource base or reflecting whatever results from the rationalization process. There's another approach, however, the "economic approach" of trying to optimize resources and use. The point is that most agencies do not necessarily set their own objectives in context of those from other agencies in order to optimize the total product throughout the province. It's not the approach to say "what is the optimum allocation of our resources to achieve net benefits for the province." Everyone has certain mandates, certain demands on their resource, present and predicted ones, and they have objectives to achieve. My question is, how do I work with both the objective-oriented approach and the optimizing approach in terms of economics? I think there are subtle differences and am not sure how we can marry these two approaches.

The question is do we try solely to achieve each sector's objectives and combine them in some optimal manner, or can we, in effect, overlook the agency's objectives by trying to optimize the resource base from the beginning?

SUSAN CALP:

Wouldn't it come out similarly in the end, regardless of the approach?

CRAIG TAYLOR:

I haven't yet seen an economic rationalization for the use of any particular resource sector to show the net benefit of using it, or that achieving our objectives is positive.

SUSAN CALP:

Maybe part of the problem so far is that we haven't yet put numbers on the resource sectors, then tried to fit them together in the big picture. We've tried to do this between agriculture and forestry, particularly with regard to the land base study, but this certainly isn't the end of it. We've recognized for some time that we must quantify what we're going to do, starting with our commitments – those actions to which we are legislatively or politically committed. What do we have beyond that? What is the potential?

CRAIG TAYLOR:

What are the long-term commitments for forest land use, irrigation, or to provide ducks for international transfer for recreation?

SUSAN CALP:

Once we put the numbers on the resources and depending on whether we want to use what is, in effect, committed in terms of management, don't think it's really all that difficult to look at different options. Th objectives can relate to this assessment.

MURRAY SUMMERS:

The question for Craig Taylor is, how are the agencies to do it? Ho do we express objectives now?

CRAIG TAYLOR:

We do it in terms of commitments.

MURRAY SUMMERS:

Part of the work you've been doing in the planning process has be to squeeze other agencies for objectives. If you're talking about inc porating economics in this process, it's not you people who have to it. If you act as a catalyst and ask the agencies to put the numb together, you have to rely on the agencies.

CRAIG TAYLOR:

We do, but I don't ever expect to be a number generator or evalua People say "here is our priority with our numbers, for one sector, we'd like to get it all." That's what we get now. There's no way to op ize, to do any decision-making on that basis.

ALISTAIR CRERAR:

Optimizing the numbers is the major advantage of taking the economic view. It gets you away from the sector type of claims. People are really interested in maximizing the benefit from each acre of land. They don't care whether it's only agriculture or forestry. What they want is to maximize the return from the land by whatever means will work. In some instances each sector must be at a sub-optimal level in order to achieve the maximum use of an acre of land. For example, opening the forest crown in one area creates more grass and forage for cattle or wildlife. Removing cattle from this area would make available more forage for elk, and no single resource use would actually be maximized. With the combination of the three uses — selective forestry which is a little more costly, rather light use of the grass by the cattlemen, plus a more reasonable amount of elk pasture - you get an optimization by the classical, multiple-use approach.

MURRAY SUMMERS

You have to be very careful with the sub-optimizing approach where each use may become uneconomic in itself.

ALISTAIR CRERAR:

Yes, it would be silly to make all three uses uneconomic.

MIKE KLUGMAN:

I heard someone say yesterday or the day before that there's not a perfect use for each area of land. What is done is to take the land base, rather than just a resource sector, and say that certain uses are the best uses for that land. We tend to get analogies to economics. Economics is a function of the land-use decision rather than the sole reason for the decision. As well, there has to be someone who co-ordinates the decision process to determine the best use of the land, then talks to the resource sectors. Don't say, "here is a parcel of land, what are you going to do with it?"

JOHN BROWNLEE:

We'll go back to Craig Taylor's question again to deal with the point of resource allocation versus policy and goal-setting.

MURRAY SUMMERS:

In short, isn't the purpose of the regional plans to sort out that question?

CRAIG TAYLOR:

The purpose of the regional plans is to say what each region will do to provide benefits from the use of public land and resources to achieve some of our broader provincial goals and objectives. Our approach has been to obtain the objectives the resource agencies want to achieve from commitments. The problem is that sometimes one sector or agency may question an economic objective of another sector. For example, we want from 900 to 9.2 million acres of land in the Peace River country for agricultural expansion. Forestry might question that objective. My question is, do we rationalize the objectives or do we just take what are the present commitments? I think there's a different approach in terms of including economics in this kind of assessment. There may be subtle differences to some people, but how do I deal with the objectives of one sector that another sector is going to question in economic terms?

DAVE PERRATON:

A couple of points stood out for me in the presentations today. One is the concept of modelling. The other is the concept of integrating values. I think economics can't be considered in isolation. You have to build a model of your respective systems that integrates economic, social and environmental factors. Let's take a very simple illustration of a classic conflict – forestry production versus wilderness. Forestry production is going to proceed. As Craig Taylor says, our objective is to maximize the return from economic forestry. The wilderness lobby will then present a different set of objectives. If we say that forestry's objective is overriding, we would establish wilderness areas only where there is no commercial forest production. It might be possible to set up a model to evaluate these objectives. Economicly you would get a good result, but would the social and environmental objectives of wilderness areas be met? Probably not. Now, if we put the wilderness objectives first and run our model again, the social and environmental aspects are maximized but the economic aspects are impacted severely. Somewhere between these extremes has to be an optimal point. The real problem in the model is to create weighting factors so we can find the optimal point that everybody supports. We haven't underweighted environmental values, nor overweighted economic ones. I would like to see this approach taken.

MIKE KLUGMAN:

The point is you will not make everybody happy. Your job is to make the major decision possible.

DAVE PERRATON:

Not everybody will be happy with the optimal point. It presumably hurts everybody a little, but at least everyone will be happy to the extent that the optimal point has been chosen as objectively as possible. For certain weightings that have been given, it's important they are reasonable. You have a consensus, not full agreement.

DOUG WEBSTER:

Several people have said the same thing. I'd hate to live in a world where all decisions were made on an economic basis. We'd all be living in six foot by four foot boxes. The theorists say, for example, that farming is a lifestyle. Well, will these techniques really take the intangibles into account? As we saw yesterday, they don't. The techniques don't operationalize very well the intangibles such as the value of wilderness. The economic analysis is just one part of the resource decision. You could look at it in just two ways. The Government of Alberta works on a very sectoral level; that's a reality. Maybe it's a losing battle to use the idealistic approach to find out the best use of the land. This point may be reflected in Alf Birch's methodology which was institutionally realistic. Everybody puts forward their own, selfish "best-shot" and you work it from that point onward. I don't know if you can really achieve the optimum in any way.

RAE RUNGE:

We've seen that part of the function of the regional plan is to vet politically-conceptual ideas against what is the reality on the ground, or what, in fact, can be accomplished.

CHERYL BRADLEY:

Where do regional priorities fit into the planning process? What are the priorities for resource uses such as industry, agriculture and then, somewhere down at the bottom, recreation?

ALISTAIR CRERAR:

Resource priorities are never carved in stone. What you think is a set of priorities today will change tomorrow. You may, at the moment, call for economic considerations and that things stand on their own. When certain forces come along, however, depending on the ability of the presentation made, you will find that what seems to be eternal dissolves very quickly. There is a switch to another set of priorities.

TOM COTTRELL:

I'd like to refer to an earlier point raised by Doug Webster and Alf Birch. Doug Webster disagreed with Alf Birch's idea of looking at the best alternative, or the best scenario in each resource sector and trying to balance them. There may be some agreement in the different approaches. How can we apply Alf's approach to regional planning? Where will the standardized assumptions fit into the different approaches? How would they be used in looking at either a best scenario in one resource sector or a description of the various qualitative and quantitative aspects of the economy in the region?

ALF BIRCH:

I presented the idea of best alternative for each sector. I would agree with Doug, but the approach is not likely to include the social optimum. If we take, for example, the objective of 9.2 million acres, it's probably not realistic or desirable from the social point of view for agriculture to have all 9.2 million acres. On the other hand, it's probably not realistic for forestry to undertake its maximum scenario. Somewhere between those two objectives is going to be the best trade-off. The process gets very complicated, however, when we are dealing with more than two sectors. The trick is to identify some way of coming close to the optimum quickly and simply, by saying, "here are a few alternatives." Let's do a more extensive investigation of those few, then select which one is best and not worry too much whether or not the best is exact. This is why I suggested the possibility of looking at trade-offs that might be involved for each scenario. It gives us an idea of the range of possibilities. Some might be rejected as unrealistic, or we may want to negotiate some of them to the point where they are feasible. In the agricultural land base study we had to deal with maximums. Probably from the social point of view that's not the best way to go about it. The problem is how do we quickly, simply and understandably narrow down the range and select a few alternatives that will get closer and closer to the best choice.

MIKE KLUGMAN:

What you have to do is say "this is the land base, this is what we have; now, what do we want to do with it?" Then, you get input from the different agencies and the public, and work out the best land use guideline for the area.

ALF BIRCH:

I would want to see only one alternative use chosen. I think it is negating the whole economic aspect to just look at the land base and determine what's best. If the best use isn't feasible, we're in a difficult situation.

DOUG WEBSTER:

I think just plain common sense can immediately come up with a better scenario than the "sugarplum, fairy-tale" ones, and you don't need a lot of ecological "overkill". The point is that, as you come closer to the scenario you want, the technical resources that you apply change. The first choice could probably be made by common sense amongst professionals. As you look at a lot of different alternatives or options, the techniques of evaluation will change through the process in terms of the amount of money, energy, etc. The final choice probably involves a detailed benefit-cost study.

SUSAN CALP:

I'm not so sure that we all agree on whether the method of analysis has been all that well defined. There appears to be agreement that economic analysis should be a part of both the sub-regional planning process and the decision-making process, rather than being tacked on the end of the process.

DOUG WEBSTER:

I don't think you can come out with the technical specifications on how to do the economic analysis.

JOHN BROWNLEE:

How do we keep economics in perspective? People are saying don't become an economic planning agency, retain the social values and the knowledge of the biophysical base, use your common sense and so on. How do we do that? How do we, in government, incorporate economics in the plans? How do you sell economics as part of our decision-making process?

MURRAY SUMMERS:

That's the difficult part of the process.

BRUCE STUBBS:

With economic analysis, we now have introduced a new parameter to the resource planning process. I would like to have someone or some agency co-ordinating the process. I would also like to have the rules of the game stated clearly, and to know that they will be followed. The co-ordinator should be fair, and should not be a resource agency with a certain mandate.

The bottom line is that people from different agencies are trying to sort out resources or objectives of which they have very little knowledge, and most of these people are not here at this conference. They are the ones who must be convinced that the new economic parameter will help to make the decisions. As well, the process to get the economic data must be impartial. This process is more important than the analysis techniques. We need to have an impartial agency or person who can make a judgment about the economic matters if they come into dispute.

MURRAY SUMMERS:

In Alberta we have agricultural commitments on one end of the spectrum and forestry commitments on the other. The big grey area between could go either way, depending upon what are the best benefits to be achieved. There's a lot more flexibility in Alberta in how we allocate our resources.

JOHN BROWNLEE:

Any other broad observations from people who aren't necessarily in the middle of this topic? George Rodziewicz, sitting in the back, any broad observations from a public perspective?

GEORGE RODZIEWICZ:

From the public point of view, if members of the public were taking part in this symposium, they would have a lot of trouble understanding what people have been saying about economic applications with other resource considerations. Part of my job is to understand the planning process, then explain it to the public so they in turn can make the decision. That's why it is important to keep the discussion as simple as possible. The public has to be able to understand what you're doing. With a lot of the decisions being made between the government and the participating agencies, we should be able to take to the public the decisions or alternatives they can understand and appreciate. I would assume that the public would assume that the economic aspect would naturally be one of the considerations used in making a decision or preparing a plan. I think the people need some clarity, some understandable explanation of what we, in the government, are doing. I don't think the public is all that concerned about the whole process.

MURRAY SUMMERS:

I'd like to return to a point brought up earlier. Does the direction come from the provincial level or does it originate from within the region? The purpose of the regional plan has to be to identify those opportunities. I get very nervous when some politician says we must set as a policy 9.2 million acres of agricultural development, or similar objective for oil or forestry for that matter. I don't think politicans at their level are in a position to say that something is going to be provincial policy. I think there is real risk when politicians start telling us what we're going to do in our policies.

I don't think 9.2 million acres of agricultural land are going to do the farmers any good. Every time I pick up the newspaper I read about the number of farms that have gone into receivership. If farmers can't be successful on farms that are probably on our better agricultural land now, what are we going to do with farms on marginal land? Are we doing the farmers any favor by encouraging them to believe that there are another 9.2 million acres out there just waiting to be plowed under?

WALTER URQUHART

I would like to raise the matter where decisions made by the government or government agencies are perhaps not wholly agreed to by the private sector. The resources of government are so overwhelming, however, that the private sector has little chance of success in presenting its viewpoint to government and being understood. The government has unlimited resources to present its viewpoint. The private sector has only limited resources. I think we simply do not have the same opportunity to make our case.

JOHN BROWNLEE:

Okay, wrap-up comments. June Klassen perhaps?

JUNE KLASSEN:

How do we balance all the different, possible, viable, resource developments which the land can support? I assume it has been by negotiation among equal participants sitting around the bargaining table. I feel that an understanding of the economic implications of each possible development would help the process.

I'd also like to refer to what the politicans have said about making available more agricultural land. They think the people of Alberta who elect them want nine million acres of agricultural land. If we tell the politicians that if they want the land we have to subsidize the farmers for the rest of our lives, maybe the people of Alberta will change their position and exert some influence on the politicians.

JOHN BROWNLEE:

The last comment to Alistair Crerar.

ALISTAIR CRERAR:

I want to bring back a note of reality to this discussion. I think that, in fact, agriculture has already set the stage, put the lines on the ground and established new rules of the game in their land-base resource. The agricultural people have come up with a net-benefit analysis in agriculture. I think the other resource sectors must now scramble to come up with information of the same quality to show what would be the benefits of using the land base for timber, fish and wildlife, or some other use. The reality is that even if you don't want to do economic analysis, you must because somebody (agriculture) has already taken the ball and is running down the field. Unless equal information for other resources is brought into the process, agriculture will win by default.

RAPPORTEUR'S REMARKS

REPORT FOR WORKSHOP A

by: Ian Dyson*

We had an extremely positive session in here this morning. We were exciting, perceptive and clever. There was a high degree of consensus emerging, and I can't seem to read my notes because my nose is growing longer.

One thing that became extremely evident is that looking over the titillating potpourri of techniques that have been tantalizingly presented to us in the last few days, and getting some intuitive perception of what their applications might be is one thing, but when you actually sit down in a room and try to define the scope of the problem with the experts, you realize you have problems. The biggest laugh of our session came when Andy Bowcott suggested that the one element in which there seemed to be a strongly-emerging consensus was that we desperately needed professional help.

There are a couple of general points coming through very strongly. One is agreement that we don't want to attempt to build a state-of-the-art mechanism into the planning system right off the bat. If we try that, we'll go nowhere. It's been noted a number of times over the last few days that the key strengths of our system are the degree to which all of the participants within it feel comfortable subscribing to it, and the system's intrinsic capability to remain dynamic and evolve towards something better over time. That being so, our immediate challenge is not to attempt to adopt a state-of-the-art economic method, but to put something into effect that we can use immediately, recognizing that we'll get better at it.

There was support for the idea of using generic methods that we can apply in particular areas, without too much effort, so we can get some indication of direction of change, some numbers for magnitude, some idea of costs, and a rough indication of regional income/employment effects. There's a lot of value-added involved in such an exercise, and it's relatively painless.

In terms of the structure of the workshop, we started on valuation. We had a tough time dealing with that topic. We were looking at how we might evaluate each resource on a sectoral basis and we got quite bogged down. Things began to get better when we started dealing with efficiency and equity. I'll briefly run through some of the main items that came out of our session.

---

* Planner, Resource Planning Branch, Resource Evaluation and Planning Division, Alberta Energy and Natural Resources, Edmonton, Alberta.

First, there was agreement that we should focus on market values and use values, as these elements generally tend to be easiest to get a handle on. That's not to undervalue the other non-use values in any way, shape or form, but simply recognizes the formidable methodological problems inherent in addressing those elements well.

Second, we need to establish ground rules: start small, stay manageable, look for incremental development to get better. We're probably going to get the best value for our buck by focusing on situations where we're making choices and concentrating on areas that will facilitate decision-making – such as when we're choosing between options. In situations where there is either very clear policy direction or consensus on the main building blocks, we're probably best-off focusing on those areas where we know the decision-makers are going to be interested in the bottom line.

Third, we agreed that measurement is probably the biggest problem we face. We had quite a discussion on commonality and the desirability of establishing common denominators for the way in which we value resources. We agreed that, by comparison, this is not as significant a problem as the methodological difficulties we get into when we start discussing ways in which we're going to measure values.

The final point I'd like to address is that of accounting stance. We had quite a big discussion with no real consensus. There seemed to be a sense by the majority of the participants that we're probably better off looking provincially rather than regionally, because it's difficult to get a handle on efficiency considerations unless at least a provincial accounting stance is adopted. Also, if we're using economics in the planning process, we should use it basically on an efficiency basis rather than an equity basis. There was a feeling by a number of the participants that the whole business of equity is something of a morass. In many ways, it's inherently a political choice and there are other mechanisms, such as tax structures, for more explicitly addressing that aspect.

I know this report is quite disjointed. I think it reflects where we were in the first workshop. We all agreed, however, that our primary task is to ensure that the economic perspective becomes an inherent component of the way that we do business from now on. Thanks a lot.

REPORT FOR WORKSHOP B

by: Susan Calp*

When I was first asked if I would sum-up the session for the regional group I was rather hesitant, and I took a while to respond. I was hesitant for two reasons. One, economics is such a horrendously complex topic in terms of what the Forest Service has been examining. I guess all of us feel a little bit like that after the past two days. We had such a short time and such a diverse group, I wondered whether I would be able to summarize it. Two, I had problems wondering whether we might not all come here to sit, talk and express our concerns on how we thought things should go, not really be very up-front about it, and think that we might put something across on someone else or be able to go our own way when we went home. Then I decided that if we only just came and were able to get a basic understanding of where one another was coming from in terms of what we were trying to do in bringing economics into the planning process, then we would have come a long way. Instead, I think we've come a lot farther. Particularly in the regional group, there was very good interaction among everyone expressing what they felt were their needs.

There was certainly agreement that economics is important in several ways:

- it is an essential component when it comes to regional planning
- it should be incorporated in the decision-making process
- it shouldn't be tacked on the end
- it's important to remember it is only one component of the system
- there are social and political aspects to be dealt with
- traditional tools are available

The last point is not the problem. The tools may not be the same as those we'll use in sub-regional level, but they are available. We need land base. We don't have sector plans. We sometimes get very hung up on that aspect.

The other points made were that the rules must be defined at the beginning, that the parameters must be clarified and that we all have to speak the same language. The bottom line is that we have no choice, really. I think Alistair Crerar probably summarized it when he said someone's already running with the ball. They're down the field, they've brought economics into the decision-making process and if we don't get into it, they'll win by default. And, Alf Birch, I didn't mention that you are the ballcarrier.

---

* Manager, Resource Planning Section, Forest Land Use Branch, Alberta Forest Service, Alberta Energy and Natural Resources, Edmonton, Alberta.

SYMPOSIUM RAPPORTEUR

by: Dr. Guy Swinnerton*

Introduction

As we come to the conclusion of this symposium, I have been given the rather daunting task of drawing together the overall theme and identifying some of the major issues discussed over the past couple of days.

May I make a disclaimer at the outset. I am not an economist and, therefore, I am not going to attempt to evaluate the content of the 12 presentations on the strength of their respective economic arguments.

I suppose I should also apologize for being an academic – following the comment of my University of Alberta colleague, Dr. Terry Veeman on Wednesday, when he defined an academic as "someone who talks while everybody else sleeps." Consequently, I will try to keep my comments short and to the point.

I must admit that being assigned the responsibility of rapporteur has meant a level of note-taking which I am not necessarily prone to do. It has been a salutary exercise, one to which I think all academics should be exposed. I now have considerable empathy with my students as far as note-taking and prolonged concentration in lectures is concerned.

The theme of the symposium – the "Role of Economics in Integrated Resource Management" – is a topical one. This conference has itself been preceded by a number of conferences here in Alberta which have addressed somewhat similar issues. I am thinking specifically of the symposium on "Fish & Wildlife Resources and Economic Development" (1983) sponsored by the Alberta Society of Professional Biologists and the Fish and Wildlife Division of Energy and Natural Resources. Earlier this year we had the conference "Economy and Ecology, Economics of Environmental Protection", sponsored by the Alberta Chapter of the Canadian Society of Environmental Biologists.

We have heard, over the last couple of days, 12 papers that have moved from the context and general principles of using economics in the carrying out of integrated resource management (IRM) on public land, to the situation in other provinces and countries, to examining the application of specific economic-evaluation techniques. In reviewing the symposium proceedings, I think reviewing the papers in the order they were presented is a logical approach. Having done that, I will reiterate some of the issues I feel were particularly important on the basis of the frequency with which they were mentioned. I hasten to add that I have not

---

* Department of Recreation and Leisure Studies, Faculty of Physical Education and Recreation, The University of Alberta, Edmonton, Alberta.

undertaken any scientific research exercise such as content analysis to come up with my conclusions.

The Main Issues

On Wednesday afternoon you may recall that because of the unfortunate absence of the Hon. Don Sparrow, Associate Minister of Public Lands and Wildlife, **Mr. Stephen Stiles MLA** read the keynote address. Such addresses are supposed to set the context for the subsequent proceedings. This address was no exception.

The important points presented by Mr. Stiles were:

1. Purpose: to seek consensus of all participants as to the role that economics should play in IRM.
2. He rightly recognized the disparate nature of the constituent groups that have both an active and more passive interest in integrated resource planning – government, industry and the public.
3. The importance and scale of the task before us was brought home by the fact that Alberta is predominantly a resource-based economy and nearly two-thirds of the province's land base is public land.
4. He reminded us that the goal of integrated resource planning is to optimize the use of resources for the maximum benefit of Albertans both now and in the future.
5. He both explicitly and implicitly raised a number of questions: What is optimum? How do we measure benefits? What is the public interest?
6. He pointed to the fact that we must include economic information with other resource management information.
7. Reference was made to non-market values, an issue which was to become one of the most important considerations of the symposium.
8. He also reminded us that integrated resource planning must be developed within the reality of the Alberta situation.

I presume by that comment that he meant we must see it in the context of a government policy geared predominantly to economic recovery and deregulation. Personally, I have some concern in that regard unless we have balance.

The second presentation by **Mr. Les Cooke** provided us with an excellent historical overview of resource management in the province, from a single-use mentality and autonomous decision-making to the work of the Canada Land Inventory, the birth of the committee system and the attempt to create linkage mechanisms. He rightly observed that by the

1970s we had recognized that the concept of multiple-use should not be applied to all land, and that planning should be proactive rather than solely reactive.

His explicit comment that IRM is not an entity unto itself, but rather a means to an end, is one we should always have in mind.

I also liked the list of principles he gave us within which IRM operates. They may be summarized as:

1. It occurs within an hierarchical framework.
2. It is a progressive refinement of management decisions: policy, planning and administration.
3. It is an objective process with an underlying rationale.
4. It is oriented toward benefits.
5. Efficient resource management requires that we recognize that the resource base offers opportunities but also imposes certain constraints.
6. The system is dynamic and flexible.
7. The process must be participatory involving relevant constituents.

Les Cooke's considerable experience in the field was well illustrated by his observation of integrated resource management over the last ten years. In talking about the current situation and the immediate future, he rightly pointed to the need to consider economics as an integral part of the total planning process and not as an appendage to an otherwise completed physical plan. This point you may recall was taken up by a number of subsequent speakers.

The question of balance was also raised, as was the point on how changing circumstances can influence this balance. The case of the Eastern Slopes Policy, and specifically the difference between the original 1977 policy and the revised policy of 1984, was used to illustrate this point.

Without going into the respective merits or shortcomings of the revised plan, I cannot help but make one observation that Les Cooke talked about, in his list of observations about IRM over the last ten years – the need for marketing and introducing the people to changing concepts. With respect, I don't think this was done particularly well with the Revised Eastern Slopes Policy. I think considerable care needs to be taken in sensitizing Albertans to the growing significance of economics in IRM.

When talking about the nature of planning we need to distinguish between planning as a process by which a plan is prepared, and the acceptability and merit of the substance of the plan. In this regard, it is important to recognize the distinction between planning as an activity –

techno-methodological aspects – and the broader concept of planning as a process – which is much more socio-political in nature. Both components are required for the successful development and implementation of a plan or management strategy.

Dr. Terry Veeman provided us with a comprehensive overview of the application of economic analysis to public land and resource management. The availability of his paper has meant that all of you have had time to digest the seminal thoughts contained therein.

I would just like to take this opportunity to remind you of the four categories of values he identified:

1. Economic values for which market prices exist and for which prices correctly reflect societal opportunity costs.
2. Economic values for which market prices exist but that do not reflect appropriate scarcity values.
3. Economic values for which no market prices exist but for which appropriate social values can be approximated in money terms by inferring what consumers would be willing to pay for the product or service. This theme was developed by Dr. Elizabeth Wilman in a subsequent presentation.
4. Values for which it would be difficult to imagine any kind of market-like process capable of registering a meaningful monetary valuation.

Dr. Veeman rightly pointed out that these categories become increasingly difficult to measure, and that 3 and 4 are particularly difficult to deal with; we must not neglect them.

His paper is also notable for ten specific rules for efficient resource allocation. I commend them to you for more careful reading and absorption.

As a person particularly interested in non-consumptive forms of outdoor recreation and the conservation of amenity resources, I think two rules are particularly relevant: Rule 4 – be sure to consider extra market values, and Rule 10 – avoid irreversibility in renewable resource use, particularly when resources are unique or in short supply.

Implicit in Dr. Veeman's rules is the need to consider:

Option Values – the desire to be able to use environmental resources in the future.

Existence Values – the environmental resources continue to exist whether or not they are used.

Bequest Values – the desire to pass on environmental resources to future generations.

Dr. Wilman also considered these aspects in her presentation. With reference to Rule 10 it is also important to point out the problems associated with the argument that we can take timber from a wilderness area because in due course regeneration will take place. I believe it was Krutilla who made the important observation about two shortcomings of such a perspective:

1. The long-term delay during which it would be evident that an area was not wilderness.
2. The need to retain authenticity of a resource even though only a small proportion of the population would fully appreciate this attribute.

An analogy might be the difference between a quality reproduction as opposed to an original painting, though only a connoisseur might fully appreciate the authenticity.

My impression from Dr. Veeman's paper was that while he advocates the need for economic measures he is also cognizant of the need to ensure that they meet his ten rules when applied to integrated resource management.

To end the first afternoon, **Mr. Stephen Stiles MLA** returned to the podium to talk about economic information in political decision-making in Alberta.

This presentation reminded us of the broader political context within which all planning takes place. In this regard, it is important to consider that ultimately it is the political process that both initiates and ultimately sanctions a planning exercise. Mr. Stiles' observation that the role of the government has changed in emphasis from a ''doer'' to a ''facilitator'' is an accurate summation of what is happening in many areas. The growing role of privatization is clearly an issue here.

He made reference to the recommendations of the Jean D'Or Prairie Sub-Regional Integrated Resource Plan which includes adding 65 000 acres to the White Area. He raised the question of opening up more land with the possibility of agricultural surplus and implicitly, what the future circumstances might be for agriculture in the province.

His comments reminded me of a discussion that took place at an international conference on the ''Management of Rural Resources: Problems and Policies'' I attended at the University of Guelph in June. The issue under discussion was the declining agricultural land base and its significance for food production.

The British delegation was bemused by the fact that Canadians were only relatively recently studying the nature and extent of the agricultural land base. In Britain where land shortage was an issue in the early 1970s, the topic is now rather passe. Land is now being transferred out of agriculture to alternative uses because of surplus in the EEC. This situation demonstrates an almost complete turn-round over a short time and points to the need for a realistic long-term assessment of policies. For many, the protection of the agricultural land base is a social issue and the symbolism associated with farming.

The series of papers yesterday morning concerned themselves with experiences in British Columbia, Ontario and the United States. Such exercises are useful but I think we have to be careful not to look at other experiences as models which of necessity have to be replicated in Alberta or in our own environment, wherever that may be. At the same time, it is not always necessary to re-invent the wheel in terms of approaches to resource planning and management.

Dr. Roger Reid from British Columbia provided us with some useful insights to the jurisdictional arrangement in BC relating to natural resources. He highlighted some important issues in his presentation, including:

1. Forecasting over extended time horizons.
2. Trying to make forecasts on limited data.
3. The problem of the lack of consensus as to what discount rate to use.
4. The fact that benefit-cost analysis does not provide the total answer to evaluating management options. In this context, he explained to us the multi-account framework which looks beyond the sole criterion of economic efficiency.

I found particularly useful the attention he drew to the three broad categories of management options:

1. Supply options – increase supply.
2. Demand options – reduce demand or shift demand in time and place.
3. Hybrid-Demand/Supply – controlled increase in supply and manipulation of demand.

The need to select the most appropriate one of these broad management options was subsequently emphasized by Dr. Marv Anderson in the context of the South Saskatchewan River Basin Study. The difficulty of measuring non-market values was also noted.

Dr. Mike Klugman shared with us the Ontario experience. His presentation focused primarily on the organizational system within which resource management takes place. He emphasized the different styles of management and operation.

Dr. John Hof brought to the audience a selected overview of the U.S. experience. He provided us with an insight into aspects of national planning and forest level planning. More specifically, he took us through the more distinctive aspects of TAMM – Timber Assessment Market Model, a market simulation model, and FORPLAN, an optimization model – using the maximization objective functions of linear programming.

One could not help but be impressed by the vast array of variables considered in these models.

Although I don't foresee the application of such models to the Alberta situation with such complexity in the near future, the underlying concepts and principles clearly have to be considered carefully, and attempted initially at perhaps a more limited scale.

Mr. Sandy Bruce dealt with private sector decision-making. He provided a very comprehensive overview using ESSO's Cold Lake Project as an example. He shared with us a number of relevant thoughts including:

1. Public and private objectives can be mutually accomplished.
2. The need for close cooperation between the private sector, the public and the community.
3. The early resolution of potential problems through dialogue between the constituent groups.

He also mentioned some concerns about the continuing role of judgment calls, and the problems of prediction errors.

Dr. Douglas Webster dealt with regional socio-economic impacts of integrated resource plans. He also made us realize some of the reality of what we are trying to do, namely:

1. Planning is sub-optimal in terms of end product.
2. No matter what we do some interest group will be disadvantaged by intervention – a salutary thought.
3. It is much easier to talk about methods than to implement them.
4. Any models which we use are only as good as the assumptions we make about the future.

Dr. Webster referred to the need to internalize socio-economic analysis rather than for it to be a post-plan exercise.

Like Dr. Veeman, he gave us a number of pointers we need to consider. I will not repeat them all but will mention some because they reiterate what a number of speakers referred to:

1. The question of scale (region/provincial) in terms of the accounting stance.
2. A lack of social content in IRM.
3. The issue of what discount rate to choose.

The point I was particularly pleased to see he noted was the effect of synergism when dealing with the impact of development. A lack of appreciation of the synergistic effects is all too common in the use of standards for environmental regulation which tend to be applied on an individual and incremental basis.

Dr. Marv Anderson discussed multiple objective planning, using the "South Saskatchewan River Basin Planning Program" (SSRBPP) as a case example. He stressed the importance of identifying the component needs associated with such an exercise. Within his presentation he recognized that the benefit-cost framework is in reality a subset of the broader planning framework.

The complexity of the planning exercise was well illustrated by the nine sectors involved in the SSRBPP study.

Dr. Elizabeth Wilman discussed valuing intangible benefits and non-market commodities. I appreciate that I might be somewhat biased because of my own particular interests, but I feel this is one of the more critical areas when we come to using economics in IRM. Dr. Wilman made the important point that just because we cannot measure all costs and benefits perfectly does not mean we should rely entirely on subjectivity.

She went on to give us a very comprehensive view of the subject, distinguishing between user services, such as recreation, where there is an observable trace of consumption in the market and non-user services, where there is no such trace. The existence of wilderness values was provided as an example of the latter. She elaborated on this distinction by demonstrating how we can measure user services using such indirect market information as the travel/cost method developed by Clawson, and the hypothetical, contingent valuation approach which reflects willingness-to-pay.

She made the important point that quite often a site for recreation is not destroyed but changed in terms of some of its attributes. The use of the recreation opportunity spectrum in recreation planning accommodates this point by recognizing that the value of a site for recreation is a combination of the physical, biological, social and managerial characteristics. Modification of one or more of these attributes can affect the type of use of a site without necessarily destroying it. An important point is that the quality of the recreation experience or the satisfaction derived is not accounted for in the absence or presence of features, but is very personal and is ultimately related to the level of congruence between expectation and on-site experience.

The final presentation by **Dr. John Livernois** dealt with econometric modelling. For those not familiar with the topic, I suspect it was approached with an element of apprehension. He provided an excellent introduction to the concept, and unravelled some of the mysteries of econometric modelling. From the limited number of examples he shared with us there is clearly considerable opportunity for its application in the field of IRM.

Recurring Themes

In conclusion, I think it is appropriate to re-emphasize a number of important points.

1. General acceptance of the need for the increased use of economics in integrated resource planning, and integrating economics in the total planning exercise rather than as an after thought.
2. There are some qualifiers to be made:
   (a) The introduction of economics and associated techniques, such as benefit-cost analysis, is just one further input tool in the decision-making process. It does not provide a panacea or technological fix to the problem.

   (b) Although we have talked about the need for consensus, the introduction of economic factors in many ways makes it more difficult to achieve, not least because of the problem of integrating sectors which have clearly defined market values with those that don't.

   From some of the comments I have heard there is still a fear that those sectors which largely have to present their case on non-market values will be short-changed in the final analysis. In other words, the potential conflict will be enhanced, initially at least, with the introduction of economics.

   (c) In this context, the observation might be made that the integrated resource plans produced to date confirm the status quo. The approach seems to be one of alternative uses having to make the case for change rather than existing uses defending theirs. Knowing the predominant actors with the land base, at present I think economics will do little to bring about change particularly when non-market values are considered for a number of sector interests.

The importance of non-market values is clearly important, and one that has to be addressed. Reference to a book by Peterson & Randall – "Valuation of Wildland Resource Benefits" – reveals the possible significance of option and existence values in examining wildland benefits.

3. The need to recognize some of the specific difficulties that have to be recognized and accounted for:
    (a) Discount Rates – which one is the most appropriate while recognizing the importance of the different rates to different resource-using sectors.
    (b) Accounting Stance – provincial/regional/local.
    (c) The difficulty of extended time horizons and the further you get into the future the broader the confidence limits invariably must become.

        It is instructive in this regard that recent recreation projections in the US have stressed that, in the future, agencies must be much more adaptable and capable of adjusting to exogeneous changes.
    (d) The diversity of interest groups involved directly and indirectly – multiplicity of sectors within the public domain including commercial interests and community interests.
4. The issue remains – what should we be looking at in terms of measuring value:
    (a) Efficiency.
    (b) User values.
    (c) Economic effects of impacts.
    (d) Opportunity costs associated with the use of a resource in a particular way.

    In the absence of any really common denominator, economic values have become the common denominator, though application of them is not without difficulties.
5. The need to develop a body of economic expertise in-house.
6. The importance of value judgments will remain.
7. Clearly a need to identify and articulate a series of assumptions with which the various sectoral interest groups are able to work. This requires a clarity of terminology; for example, concept of value. Establish the rules of the game before you start. These ground rules must be established at the outset of a planning exercise.
8. The gradual process of integrating economics in the process while at the same time recognizing that the intent is not to produce a detailed economic plan. I sense a feeling of cautious optimism.

Finally, I would like to commend the organizers for hosting this excellent symposium. I think a very good start has been made. I wish you well in your future endeavors and urge you to continue the dialogue.

APPENDIX 1
SYMPOSIUM PARTICIPANTS

Anderson, Marv
Marv Anderson & Associates Ltd.
Edmonton

Anielski, Mark
Alberta Energy and Natural Resources
Alberta Forest Service
Edmonton

Belyea, Dave
Alberta Energy and Natural Resources
Resource Evaluation and Planning Division
Edmonton

Bloomfield, Jan
Alberta Tourism and Small Business
Development Branch
Edmonton

Bowcott, Andy
Alberta Energy and Natural Resources
Resource Evaluation and Planning Division
Edmonton

Bron, Annette
Alberta Energy and Natural Resources
Resource Evaluation and Planning Division
Edmonton

Brown, Sandy
Alberta Energy and Natural Resources
Resource Evaluation and Planning Division
Edmonton

Calp, Susan
Alberta Energy and Natural Resources
Alberta Forest Service
Edmonton

Chinery, Brian
Alberta Energy and Natural Resources
Resource Evaluation and Planning Division
Edmonton

Coape-Arnold, Tom
DPA Group
Calgary

Cottrell, Tom
Alberta Energy and Natural Resources
Resource Evaluation and Planning Division
Edmonton

Andries, Kirk
Alberta Energy and Natural Resources
Resource Evaluation and Planning Division
Edmonton

Appleby, Don
Community Advisory Committee
Medley, Alberta

Birch, Alfred
Alberta Agriculture
Resource Planning Division
Edmonton

Bodden, Ken
Alberta Energy and Natural Resources
Fish and Wildlife Division
Edmonton

Bradley, Cheryl
Alberta Wilderness Association
Calgary

Brownlee, John
Alberta Energy and Natural Resources
Resource Evaluation and Planning Division
Edmonton

Bruce, Sandy
Esso Resources Canada Ltd.
Oil Sands and Coal Department
Calgary

Carl, Leon
Alberta Energy and Natural Resources
Fish and Wildlife Division
Edmonton

Christie, R. Morley
Alberta Energy and Natural Resources
Resource Evaluation and Planning Division
Edmonton

Cooke, Les
Alberta Energy and Natural Resources
Resource Evaluation and Planning Division
Edmonton

Coulson, Lanny
Alberta Energy and Natural Resources
Resource Evaluation and Planning Division
Edmonton

Crane, Ken
Coal Association of Canada
Luscar Ltd.
Edmonton

Delaney, Basil
Alberta Energy and Natural Resources
Resource Evaluation and Planning Division
Edmonton

Duchesne, Larry
Alberta Recreation and Parks
Design and Implementation Division
Edmonton

Fardoe, Brian
Alberta Energy and Natural Resources
Resource Evaluation and Planning Division
Edmonton

Fullen, Len
Alberta Agriculture
Resource Planning Division
Edmonton

Gillespie, Ed
Alberta Energy and Natural Resources
Alberta Forest Service
Edmonton

Graham, Jack
Alberta Fish & Game Association
Edmonton

Hof, John
U.S. Department of Agriculture
Forest Service
Rocky Mountain Forest and Range
Experiment Station
Fort Collins, Colorado

Jacks, Johanna
Alberta Energy and Natural Resources
Resource Evaluation and Planning Division
Edmonton

Kinnear, Peter
Alberta Energy and Natural Resources
Resource Evaluation and Planning Division
Edmonton

Klugman, Mike
Ministry of Natural Resources
Sudbury, Ontario

Kondla, Norbert
Alberta Energy and Natural Resources
Resource Evaluation and Planning Division
Lethbridge

Crerar, Alistair
Environment Council of Alberta
Edmonton

Donahue, Paul
Alberta Culture
Historic Sites Services
Edmonton

Dyson, Ian
Alberta Energy and Natural Resources
Resource Evaluation and Planning Division
Edmonton

Fregren, Don
Alberta Energy and Natural Resources
Alberta Forest Service
Edmonton

Gendron, Jim
Alberta Energy and Natural Resources
Resource Evaluation and Planning Division
St. Paul, Alberta

Goodkey, Rich
Alberta Treasury
Budget Bureau
Edmonton

Harrower, John
Alberta Energy and Natural Resources
Resource Evaluation and Planning Division
Edmonton

Hudson, Brian
Alberta Energy and Natural Resources
Mineral Resources Division
Edmonton

Kiddine, Karolyne
Legislative Staff
Edmonton

Klassen, June
Stewart, Weir & Co.
Edmonton

Knedlick, Will
Lincoln Institute of Land Policy
Intergovernmental Programs
Kirkland, Washington

Kostashuk, Doug
Alberta Energy and Natural Resources
Resource Evaluation and Planning Division
Edmonton

Laface, Barb
Alberta Energy and Natural Resources
Resource Evaluation and Planning Division
Edmonton

Leggat, Keith
Alberta Energy and Natural Resources
Resource Evaluation and Planning Division
Edmonton

Livernois, John
University of Alberta
Department of Economics
Edmonton

Marczyk, John
Alberta Energy and Natural Resources
Resource Evaluation and Planning Division
Edmonton

McGregor, Cameron
Alberta Energy and Natural Resources
Resource Evaluation and Planning Division
Edmonton

Melnyk, Mike
Alberta Energy and Natural Resources
Fish and Wildlife Division
Edmonton

Mink, Frank
Energy Resources Conservation Board
Economics Dept.
Calgary

Mortemore, Nora
Alberta Energy and Natural Resources
Resource Evaluation and Planning Division
Edmonton

Peter, Art
Alberta Energy and Natural Resources
Alberta Forest Service
Calgary

Phillips, Bill
University of Alberta
Department of Rural Economics
Edmonton

Protti, Gerry
Alberta Energy and Natural Resources
Economic Planning & Financial Analysis
Edmonton

Rennick, Paul
Landplan
Guelph, Ontario

Rodziewicz, George
Alberta Energy and Natural Resources
Communications Branch
Edmonton

Lee, Peter
Alberta Energy and Natural Resources
Public Lands Division
Edmonton

Litke, Jay
Alberta Energy and Natural Resources
Legislature Building
Edmonton

MacKenzie, John
Mobil Oil Canada Ltd.
Calgary

McArthur, Dave
North East Regional Economic Development Council
Lac La Biche, Alberta

Mead, Doug
Shell Canada Resources Limited
Calgary

Miller, Ron
Alberta Energy and Natural Resources
Public Lands Division
Edmonton

Morrison, Bob
Alberta Environment
Planning Division
Calgary

Perraton, Dave
Alberta Recreation & Parks
Design & Implementation Division
Edmonton

Pharis, Vivian
Alberta Wilderness Association
Calgary

Precht, Paul
Alberta Energy and Natural Resources
Economic Planning & Financial Analysis
Edmonton

Reid, Roger
Ministry of Environment
Victoria, B.C.

Rivait, Jim
Alberta Energy and Natural Resources
Resource Evaluation and Planning Division
Edmonton

Runge, Rae
Alberta Municipal Affairs
Planning Branch
Edmonton

Russell, Don
Alberta Economic Development
Strategic Planning Branch
Edmonton

Short, Paul
Alberta Energy and Natural Resources
Resource Evaluation and Planning Division
Edmonton

Stiles, Stephen, MLA
Olds Didsbury
Edmonton

Summers, Murray
Alberta Forest Products Association
Blue Ridge Lumber (1981) Ltd.
Whitecourt

Szarko, Don
Alberta Transportation
Urban Transportation & Planning Division
Edmonton

Turnbull, Murray
Alberta Energy and Natural Resources
Public Lands Division
Edmonton

Van Waas, Neil
Alberta Energy and Natural Resources
Resource Evaluation and Planning Division
Rocky Mountain House

Weatherhill, Ron
Alberta Energy and Natural Resources
Fish and Wildlife Division
Edmonton

Whitehead, Tim
Yellowhead Regional Planning Commission
Onoway, Alberta

Wilman, Liz
University of Calgary
Department of Economics
Calgary

Younie, Doug
Alberta Environment
Planning Division
Edmonton

Shaneman, Roger
Coal Association of Canada
Manalta Coal Ltd.
Calgary

Sparrow, Don, MLA
Associate Minister
Public Lands and Wildlife
Edmonton

Stubbs, Bruce
Alberta Energy and Natural Resources
Fish and Wildlife Division
Edmonton

Swinnerton, Guy
University of Alberta
Department of Recreation & Leisure Studies
Edmonton

Taylor, Craig
Alberta Energy and Natural Resources
Resource Evaluation and Planning Division
Edmonton

Urquhart, Walter
Tourism Industry Association of Alberta
Jasper

Veeman, Terry
University of Alberta
Department of Economics
Edmonton

Webster, Doug
University of Calgary
Faculty of Environmental Design
Calgary

Williams, Kevin
Alberta Energy and Natural Resources
Mineral Resources Division
Edmonton

Wyldman, Ed
Alberta Energy and Natural Resources
Resource Evaluation and Planning Division
Edmonton

Zdan, Terry
Alberta Environment
Planning Division
Edmonton